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SELECTING THE TYPE OF HIGHWAY SURFACING

Among the papers presented before the road meeting at Worcester last month was one by Major Crosby entitled "The Selection of Types for Road Surfaces." This paper, which is presented in abstract elsewhere in this issue, brings up a subject to which "Good Roads" has given considerable space on more or less frequent occasions in the past. While little or nothing that is new can be said on the subject, it is one of so much importance that it seems worth while to again emphasize some of the salient points of the problem.

The two most important phases of the question are, first, upon whom should devolve the duty of selecting the type of surfacing for a given case, and, second, how should the selection be made.

In these days of specialization in every line of work, it would seem superfluous to argue the necessity for delegating to an engineer the work of selecting the kind of pavement to put down on a given city street or country road. The fact remains, however, that this problem, which involves in its proper solution a very considerable amount of engineering knowledge and experience, is often left to laymen. In more than a few places the owners of abutting property have the right of designating the character of improvement to be made in the street or road upon which their property fronts. In such cases there is, of course, little likelihood that the most suitable pavement will be chosen. Depending upon whether or not the property owners themselves occupy their premises and also upon other conditions, the choice will be either the pavement which most appeals to the whims of the majority or that one which can be put down for the least money and will, therefore, carry with its construction the smallest assessment.

This result can be expected when the property owners are not subject to outside influence. Unfortunately, there is sometimes injected into the proceedings the influence of salesmen or others, who, for the sake of the profit which will accrue to them, do their utmost to bring about the selection of some particular type of pavement regardless of its suitability.

The remedy for this state of affairs will, in most cases, be found in legislation, which in turn must result from a realization of the necessity for a change in conditions. Probably this change will be made eventually, but the growth of public sentiment, which must precede it, will be slow. It can be accelerated, however, by the proper educational work, and this is a task to which engineers can well devote a portion of their time and energy.

The second phase of the problem—the methods to be employed in the selection—is well covered in the paper referred to. Assuming that the engineer has been intrusted with the work of determining the kind of pavement or surfacing to be used in a given case, the public has a right to assume that he will apply his engineering knowledge and experience and not be guided solely by what Major Crosby has aptly termed "judgment." With the data now generally available, it is doubtless impracticable to reduce the problem to an exact mathematical calculation. At the same time, as pointed out in the paper, there are involved certain fundamental principles, perhaps even formulae, which are applicable to the majority of cases. There are certain factors or certain requirements which always enter into the problem, and in any given case weights which will be approximately correct can readily be assigned to them. On the other hand, the weights assigned in any one case may be entirely different from those which should be assigned in another case. In other words, any set list of requirements, with a certain definite weight for each one, can not be established for all conditions. This is also a point that is brought out in Major Crosby's paper. The task of the engineer, therefore, involves not only an examination of various types of surfacings with a view to ascertaining their suitability under varying conditions, but also the work of assigning to the several requirements of the ideal pavement for the case under consideration, the weights which are proper under the conditions obtaining.

While in no way neglecting the work of perfecting methods of selecting pavements, engineers should take up the equally important work of placing the selection of surfacings in the hands of engineers, where it properly belongs.

CONTRIBUTED ARTICLES

About four years ago, under the above caption, we printed an editorial calling to the attention of engineers their opportunities to serve their coworkers—and incidentally to secure for themselves a fair return for the labor involved—by putting their experiences in the form of articles for publication in the technical press. At the beginning of a new year, it seems appropriate to repeat, in substance, what was pointed out in the editorial referred to.

The kinds of matter which a journal like "Good Roads" is called upon to print are many, but included in what may be termed the "technical matter" are two very important classes. The first consists of papers presented at meetings of engineers and road builders, and the second of special articles describing particular work. The latter can best be prepared by those who are doing the work.

Very few engineers, however, realize their opportunity for technical writing. In the first place, the highway engineer does not realize the interest which his every-day work may have for some other engineer engaged in the same field. In the second place, he does not realize that the preparation of a description of the work or of some special phase of it would be of any benefit to him. Lastly, the average engineer is apt to distrust his own ability to write an article.

As a matter of fact, almost every engineer engaged in work of any importance occasionally finds a way of doing something, or observes some operation performed by someone else, which differs from the usual and which could be made the basis of an article which would be of interest to many of his coworkers. It often happens that an article descriptive of some seemingly insignificant matter, some detail of construction, is the article which makes the greatest appeal to the readers of a technical publication.

In regard to the engineer's hesitation in writing for publication because he feels that he lacks literary ability, it need only be pointed out that literary excellence may well have the least weight with the editor who passes upon the availability of an article. The matter which the article contains is of infinitely more importance than the method in which the data are set forth, and the publication has a staff whose special work it is to see that the facts and figures are presented in the best possible manner.

The matter of compensation is one relative to which there is considerable misunderstanding among laymen. The engineer who writes an article and submits it to a reputable journal will be paid for accepted articles at the rates current for the kind of matter which he submits.

"Good Roads," like every other publication, receives many good articles. It wants more, however, and it is the wish of the editors to encourage the readers to submit matter of the kind outlined in the preceding paragraphs. A clear, concise description of work done, accompanied if possible by photographs or black and white drawings, furnishes ideal material for a valuable article. All such matter submitted is given the most careful consideration and, if available, is accepted and paid for at regular rates. Very often an article which is not acceptable in the form in which it is submitted can be made into a most valuable contribution, and in such cases the editors are glad to assist the author in making such changes or additions as seem desirable. "Good Roads" is particularly anxious to print more and more articles written by its readers and takes this opportunity to call the matter to their attention at a season when engineers and others engaged in road and street work have the most time for such work.

SNOW REMOVAL

During last month the experiences of New York and other eastern cities again demonstrated how far from perfect are present methods of snow removal. In New York, in spite of preparations resulting from the successes and failures of previous years, a not excessively heavy fall of snow seriously impeded vehicular traffic and made walking extremely disagreeable—not for a few hours, but in some parts of the city for days.

In the northern portion of the country, snowfalls must be expected during several months of the year and the public has a right to look to the proper city department for a certain measure of relief from the resulting disturbance of traffic conditions—and for relief within a reasonable time. The cleaning of streets, including the removal of snow, is rightly among the duties of street departments in many cities, while in others it is under the jurisdiction of some department closely allied to the street department in the character of its work. Whether the work should always be done by the street department is a matter of organization that need not be taken up here. Ways and means of snow removal, however, are manifestly within the scope of the highway engineer, and it is evident that sufficient study has not been given to the matter.

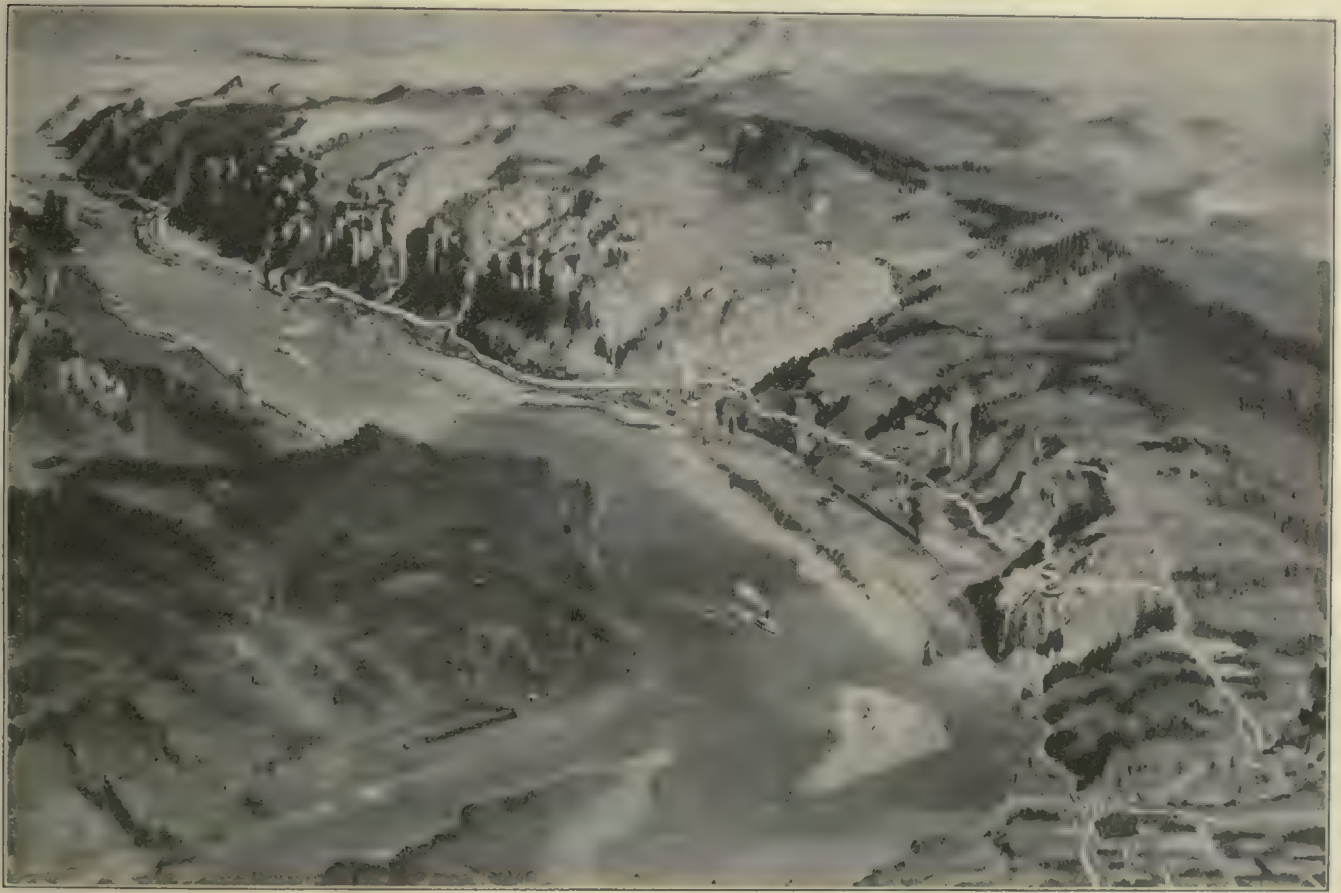
The problem has many phases, each important in itself and each more or less dependent upon the others. Existing machinery must be improved and new apparatus devised, present methods must be bettered and new ones developed, the exigencies of snow removal work must be recognized in the organization of the responsible departments and steps must be taken to overcome the obstacles interposed by labor conditions. The last is by no means the least important, for the nature of snow removal work makes it necessary to get together on short notice a large but temporary force of laborers.

Some attention has been paid to snow removal at conferences and meetings of engineers. Further consideration is desirable and it would seem that the matter could well be included among the topics for discussion at meetings of highway officials and engineers, such a meeting, for instance, as that of the American Road Builders' Association—an organization consisting principally of men actively engaged in road and street work.

The Work of the Pennsylvania State Highway Department during the season just ended has consisted almost entirely of maintenance, according to an editorial in the current issue of the "Pennsylvania Highway News." To October 1, 1915, the improved roads taken care of by the Maintenance Division included 8,262.68 miles, out of a total system of 10,200 miles. This total was made up of roads of the following types: Stone or other hard surfaced roads, 1,880.48 miles; flint, gravel and shale roads, 557.75 miles; earth roads, dragged and scraped, 5,824.45 miles. In addition to this, the division resurfaced 396.99 miles during the season.

The Columbia River Highway in Oregon

The Columbia Highway in Oregon, which follows the southern shore of the Columbia River from the "Inland Empire" to the sea, is regarded in many quarters as one of the finest scenic roads in America, if not in the world. No description of this or any other highway can give the reader more than a hint of the real beauty of the scenery. Moreover, the highway engineer is less interested in the scenic features of a road than in the engineering problems involved in its construction and the methods adopted for their solution. For these reasons, it will be left to the illustrations which accompany this article to convey such impressions as they can of the magnificent views obtainable from the Columbia Highway, and the text will be devoted to a brief historical sketch of the building of the road and to a description of some of the outstanding engineering features.



BIRD'S-EYE VIEW OF THE COLUMBIA HIGHWAY FROM HOOD RIVER TO THE PACIFIC OCEAN—FROM A PAINTING EXHIBITED BY THE ROTARY CLUB OF PORTLAND, ORE.

The illustration on this page was made from a large oil painting showing a bird's-eye view of that portion of the highway from Hood River to the Pacific Ocean. The other illustrations consist of views of some of its especially noteworthy parts and of scenes along the road.

The necessity for a highway connecting the seacoast of Oregon with the fertile country east of the Cascade Mountains has long been recognized, and efforts to secure the construction of a wagon road have been made at various times during the past half century. The first wagon road built on the Oregon side of the river was completed in 1856. It extended from Bonneville to the Cascade Locks and was less than six miles in length. In 1872 the Oregon Legislature appropriated $50,000 for the construction of a road from the mouth of the Sandy River, which flows into the Columbia near the central portion of Multnomah County, easterly through the gorge of the Columbia to The Dalles. This appropriation was expended, and four years later another appropriation of an equal amount was made. The road constructed was very narrow, poorly aligned and had excessive grades. Much of this road was destroyed when the O.-W. R. & N. Railway was built in 1882.

Among the more recent attempts to obtain a road into Eastern Oregon was one made in 1910 by Henry Wemme and others, who petitioned the Multnomah County authorities to build a road from the town of Bridal Veil easterly to the line between Multnomah and Hood River Counties. In accordance with this petition, a survey was made by the county engineer from Bonneville to the Hood River County line, and another from a point near Chanticleer to Latourell. During the next year a report by the road viewers and the county surveyor on the road between Bridal Veil and the Hood River County line was adopted. This survey contemplated the construction of a narrow wagon road having sharp curves and steep grades. The following year the county built 1.8 miles on this location east of Bridal Veil. It was necessary, however, to relocate and rebuild this section in 1914 to bring it up to standard.

In the spring of 1912, Samuel Hill took two of his friends on the train to Bonneville near the county line and walked

Photo by A. H. Barnes.
HORSE-TAIL FALLS—ON THE COLUMBIA HIGHWAY, 35 MILES EAST OF PORTLAND, OREGON.

them to Eagle Creek and then back to Warrendale. On this trip he explained to them the wonders of a scenic road up the Columbia built with standard grades and alignment and 24 ft. wide. One of the friends thought it just another of Sam Hill's visions.

In the fall of 1912, the effort to bring about the construction of a river road was renewed by S. Benson, a wealthy timber owner of Oregon, who placed in the hands of Governor Oswald West the sum of $10,000 to be used, with convict labor, in the building of a new road around the foot of Shell Rock Mountain. This mountain, which is situated in Hood River County, had been regarded as an impassable barrier, the loose rock slides having proved an effectual bar to the meager attempts that had been made towards the construction and maintenance of a road.

Photo by A. H. Barnes.
ONEONTA FALLS, AT ONEONTA GORGE, NEAR THE COLUMBIA HIGHWAY, NEAR HORSE-TAIL FALLS.

This donation served to revive interest in a river road, in spite of the lack of success attending the work done under the Hood River County authorities, and in 1913 the building of the Columbia Highway on its present magnificent scale was undertaken. The location and engineering work in connection with this road was performed by the State Highway Department, which was created by the highway law passed at the 1913 session of the Legislature. Oregon was the last of the Pacific Coast states to create a state highway department. In February of that year, the members of the Oregon Legislature were the guests of Samuel Hill on a trip by special train to his estate on the Columbia River at Maryhill, Wash. At his own expense, Mr. Hill had constructed several miles of modern hard surfaced roads near his ranch, costing $120,000. Returning from the inspection of these model roads, the Legislature passed the law providing for a state highway department.

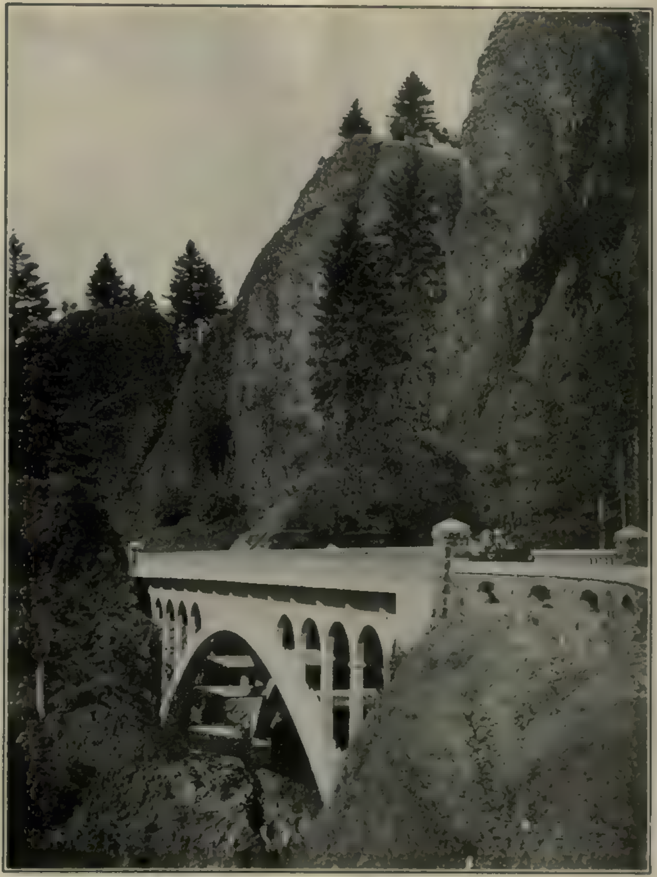


Photo by Cross & Dimmitt.
SHEPPERDS DELL BRIDGE—COLUMBIA HIGHWAY.

The Highway Commission secured the services of Henry L. Bowlby as State Highway Engineer, and started an extensive road building campaign.

The first county to take advantage of the new highway law was Jackson County. On July 3, 1913, this county turned over to the State Highway Department the location and construction of the Pacific Highway through that county and provided $500,000 from a bond issue to meet the costs of construction.

The Columbia Highway was the next to feel the impulse of the state-wide campaign for good roads. The Board of County Commissioners of Multnomah County, under the leadership of Rufus C. Holman, by resolution on July 26, 1913, appointed an advisory committee, composed of prominent business men of Portland, to advise them in connection with the new departure in modern road building.

On Sept. 24 all of the engineering in connection with the Columbia Highway was turned over to the State Highway Commission. S. C. Lancaster, a consulting highway engineer of Portland, was secured as Assistant Highway Engineer and placed in charge of the highway in Multnomah County, and the surveys started. Construction in this county began in October, 1913. Twenty-two and one-half miles of new road have been built to date at a cost of approximately one million dollars. This amount includes the cost of the many large and beautiful reinforced concrete bridges and viaducts which were described in "Good Roads" of November 6, 1915. This section of the highway is known as the Waterfalls Section because of the ten beautiful waterfalls that are passed in this distance.

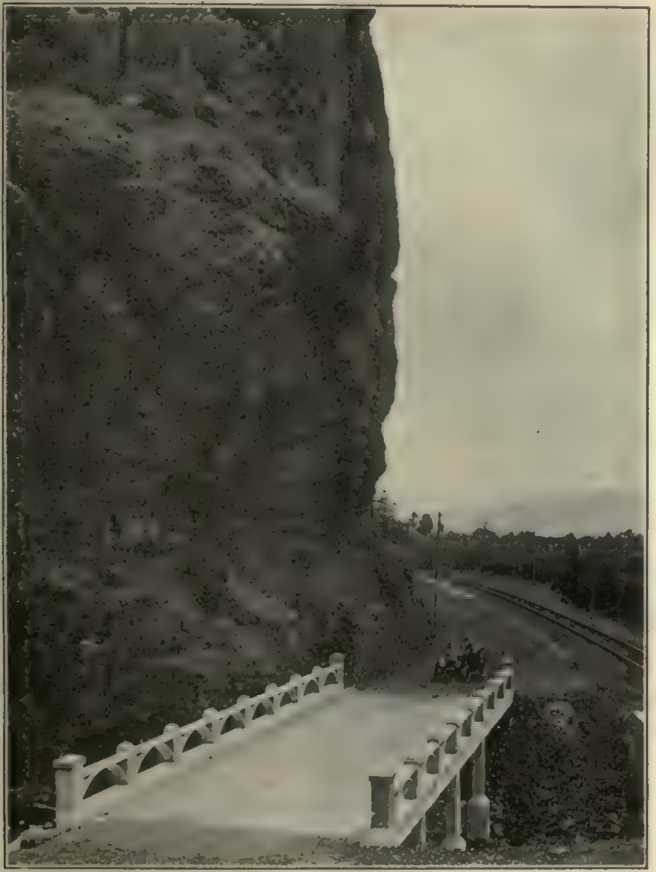


Photo by Cross & Dimmitt.
THE COLUMBIA HIGHWAY AT ONEONTA GORGE.

During the summer of 1915, 22 miles of the Columbia Highway in this county were paved with Warrenite. The hard surfacing was laid 18 ft. wide, the roadway being 24 ft. in width over all.

A history of the Columbia Highway in Multnomah County cannot be complete without a reference to County Roadmaster John B. Yeon. A man of wealth and large business affairs, he has given two years of his time free to the public and has been in active charge of the construction of the roads of the county. All of the road work, except bridges and paving, has been done under his direction by foremen and gangs of laborers. The bridges were built and the pavement was laid by contract. The cost of the pavement was approximately $15,000 per mile, including a 10-year maintenance bond.

Photo by Weister.
VIADUCT AND SIDEHILL CONSTRUCTION THROUGH SOLID ROCK AND OVER SLIDES—MULTNOMAH COUNTY.

Associated with Mr. Yeon was Amos Benson, who also gave two years of his time to this work. Through his efforts the right of way was secured practically without cost to the county or state.

Rufus C. Holman, the efficient chairman of the Board of County Commissioners, fought for the construction of this road from its inception. Until its completion, almost, he

Photo by Weister.
COLUMBIA HIGHWAY IN MULTNOMAH COUNTY—SHOWING RUBBLE WALLS AND WARRENITE PAVEMENT.

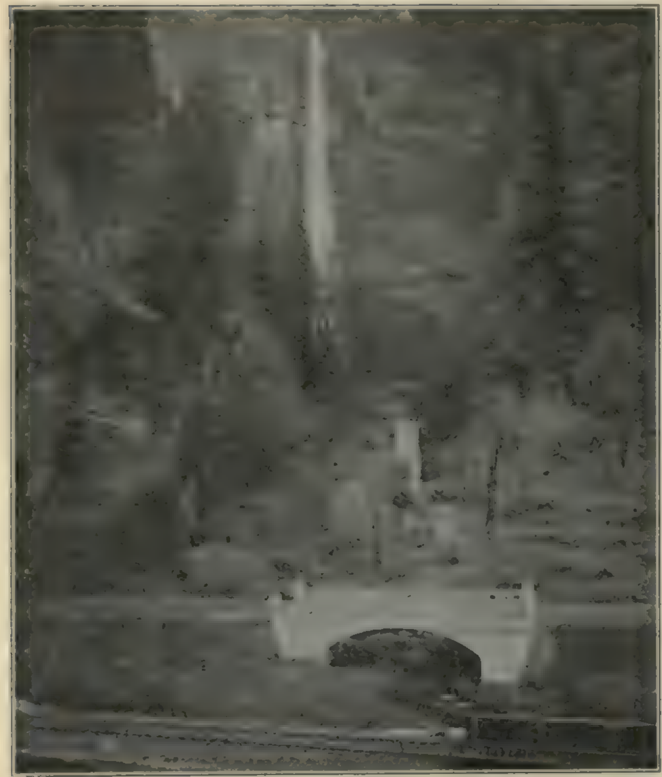


Photo by A. H. Barnes.

THE COLUMBIA HIGHWAY AND BRIDGE AT MULTNOMAH FALLS—O.-W. R. & N. RY. IN FOREGROUND, MULTNOMAH FALLS IN BACKGROUND.

was the only member of the county board who was in sympathy with the proposed scenic highway.

The Columbia Highway starts at Seaside on the Pacific Ocean in Clatsop County. It parallels the ocean beach for 12 miles and then cuts across the marshlands, a distance of 12 miles, to the city of Astoria. From Astoria east in Clatsop County the highway extends 28 miles to the Columbia County line. This section was completed with the money raised from a $400,000 county bond issue voted on Nov. 4, 1913. The surveys were started in this county by the State Highway Department on Oct. 16, 1913, and the maps, profiles and estimates were completed April 4, 1914, covering a location of 46 miles, much of it through some of the heaviest standing timber of the Northwest. The first contract was let on May 11, 1914, for 28 miles of road. This section cost, complete, including bridges and grading, $300,000. It will be hard surfaced by the state in the next few years.

The first unit of the Columbia Highway to be hard surfaced was in this county, 2 miles of Warrenite being laid between Seaside and Gearhart in 1914 and 3 miles of concrete near Warrenton the same season. On Bugbee Mountain, just east of Astoria and overlooking the mouth of the Columbia, the highway runs out of a forest of firs at an elevation of 700 ft. to descend 650 ft. on a 5 per cent. grade along the face of the cliff. The descent is accomplished by four wonderful hairpin curves, and yet the road is so located as to preserve a long sight line on each curve. This is unquestionably the grandest feature of the lower section of the highway. From the crest you command a view extending up and down the river for 40 miles.

Photo by A. H. Barnes.

VIADUCT AND BOWLBY TUNNEL DURING CONSTRUCTION—HOOD RIVER COUNTY.

Photo by Weister.

"OREGON'S AXENSTRASSE," THE TUNNEL SHOWN IN THE ILLUSTRATION AT THE BOTTOM OF OTHER COLUMN.

Following the highway up the river towards Portland, we pass through Columbia County for 56 miles. The scenery is not so grand, but the cost of construction is heavy. This county in February, 1914, voted $360,000, which was turned over to the State Highway Department to expend. The surveys started Oct. 17, 1913, and were completed on April 21, 1914. Construction was started May 17, 1914.

In Hood River County the gorge of the Columbia widens out again above the Cascades, producing some of the grandest and most rugged scenery to be encountered in the world. At one point five miles west of the city of Hood River, famous for its red apples, the highway passes through a solid rock ridge, known as Storm Crest, for a distance of

Photo by A. H. Barnes.
INTERIOR OF THE BOWLBY TUNNEL SHOWN IN ILLUSTRATION ON OPPOSITE PAGE.

Photo by Cross & Dimmitt.
THE COLUMBIA HIGHWAY AT CROWN POINT, SHOWING SIDEWALK, RAIL AND LIGHT STANDARDS.

400 ft. This tunnel reminds the tourist of the Axenstrasse on Lake Lucerne. Windows have been cut from the tunnel to the face of the basalt cliff, lighting up the interior and giving a magnificent view looking out and down onto the river and across over the neighboring state of Washington. This tunnel is 18 ft. wide and 19 ft. high with a length of 400 ft. The windows are 20 ft. wide and 19 ft. high. It is a marvelous piece of engineering workmanship and excellent results were obtained by the contractor. A bonus was provided in the specifications which made it worth while for the contractor to use great care in driving this wonderful tunnel. It has not been officially named, but by some it is called "Oregon's Axenstrasse," by others the "Bowlby Tunnel," after the State Highway Engineer who planned it and made its construction possible.

The press of Oregon aided in every way to advance the cause of highway improvement. C. S. Jackson, especially, gave his time and money to advance the cause. He believed that it would form an important link in the scheme for developing the Columbia River waterway.

To Frank Terrace, of Washington, more than to any one else, is due the credit of convincing the Oregon farmers of the value of good roads and the desirability of voting the bond issues to obtain them.

Julius L. Meier, of Portland, accepted the presidency of the Columbia Highway Association and his zeal never flagged during the prosecution of the work.

The Columbia highway in Multnomah County has been practically completed. It is described and illustrated with wonderful colored photographs in a book recently published by S. C. Lancaster, entitled "The Columbia—America's Great Highway."

One of the points of especial interest in this county is the tunnel at Oneonta Gorge, which is also shown in one of the accompanying illustrations. The highway crosses the stream on a reinforced concrete bridge and passes immediately into the tunnel, which is 125 ft. long from portal to portal. The height of the rock is 205 ft. It was impossible to leave more than 18 ft. of rock to support the side of the mountain next to the railroad track, and for this reason it was necessary to fill some of the fissures with concrete.

The road at Crown Point is also an interesting section, both because of the view obtainable from the road and the construction adopted. The road here is carried around the top of the rock on a curve of 110 ft. radius. The central angle of the curve is 225 degrees. A 7-ft. sidewalk is built on the outer edge of the road and is protected by a concrete railing 4 ft. high.

In many places along the road it was necessary to build loops on the sides of the mountains in order to increase the length of the road sufficiently to make it possible to keep within the limitations of the maximum grade of 5 per cent. Many retaining walls were also necessary on sidehills, one of these, of dry rubble masonry, being shown in one of the accompanying illustrations. These walls were built true to line and grade, and some of them were made 26 ft. in height, the thickness at the base being approximately .8 of the height, depending upon the character of the foundation.

Photo by Cross & Dimmitt.
VIEW OF CROWN POINT AND THE COLUMBIA RIVER FROM THE CROWN POINT CHALET.

The highway has a 24-ft. roadbed, both in cuts and fills, and the maximum gradient is 5 per cent. The minimum radius of curvature is 200 ft., except in a few exceptional cases. In no place has a radius of less than 100 ft. been used and where the radius of curvature is less than 200 ft., the grade on the curve has been reduced 1 per cent. for each 50 ft. of reduction in the radius.

Oswald West, Governor of the State of Oregon, 1911-1915, and Ben W. Olcott, Secretary of State, were both members of the State Highway Commission under which the State Highway Engineer acted, and their cooperation throughout made the construction of the Columbia Highway a possibility.

Worn-Out Macadam Road in Cleveland, Ohio, Resurfaced with Brick

The feasibility of utilizing worn-out macadam as a base for brick pavement is illustrated by a residence street in Cleveland, Ohio, where a pavement of this type has been in use for nearly a year and a half.

PREPARING OLD MACADAM FOR FOUNDATION FOR BRICK PAVING.

The street, which is shown in the accompanying illustrations, is known as Cedar Glen Road and is a fashionable residence thoroughfare in the eastern section of the city. It extends from the intersection of Overlook Road and Euclid Boulevard to the city limits, and throughout the greater part of its length is located on a hill. The traffic it carries is made up largely of motor vehicles and, for a residence district, is extremely heavy as the road is a sort of gateway to the rapidly growing Cleveland Heights and Shaker Heights districts. The vehicles using the road include pleasure vehicles, delivery wagons and the heavy trucks used to transport material for building operations.

LAYING AND ROLLING BRICK PAVEMENT ON CEDAR GLEN ROAD, CLEVELAND, OHIO.

The road was originally improved with telford macadam, laid with care and in accordance with the most approved specifications. Under the heavy travel, and especially the action of tire chains, the surfacing was soon destroyed, leaving the heavy stone used in the telford base projecting. When resurfacing became necessary, brick was decided upon as the material to use.

In the work of resurfacing, the projecting portions of the telford stones were removed by hand sledging, some of the pieces broken off being as large as 4 ins. in diameter. After the removal of these irregularities, slag of a size passing a 2-in. screen and retained on a 1-in. screen was spread. Smaller slag was used to fill the interstices, and the whole was sprinkled and rolled to an even surface. On this was placed a ½-in. sand cushion, which was rolled, struck off and rerolled to the desired grade. The pavement of hillside block was then laid, rolled and the joints filled with cement grout.

It is stated that an estimate of traffic placing the number of vehicles passing over the road at 3,000 a day is probably conservative. It is also stated that while results have been on the whole commendable they have been such as to point out certain features to which attention should be paid in construction of this type, probably the most important of which is the necessity of thoroughly compacting the base before the brick course is laid.

The Construction of an Automobile Highway from Wichita Falls to Fort Worth, Tex., a distance of about 100 miles, will be started soon, according to plans now being made by those interested.

Colorado and Wyoming Will Unite in Building a Highway from Denver, Colo., through the Rocky Mountain National Park in Northern Colorado, to the Yellowstone National Park in Wyoming.

LAYING BRICK PAVING BLOCKS ON SAND CUSHION RESTING ON SLAG AND OLD MACADAM BASE.

COMPLETED BRICK PAVEMENT OVER OLD MACADAM—CEDAR GLEN ROAD, CLEVELAND, OHIO.

Papers Presented at the Worcester Road Congress

Note.—In the following pages are printed abstracts of some of the more important short papers presented at the road congress held at Worcester, Mass., December 14-17, and brief reviews of some of the other papers, many of which are too long to be satisfactorily abstracted. Additional papers, which lack of space makes it impossible to present here, will be reviewed or abstracted in future issues as space permits.

The Development of Highways in Canada and What It Means to the Dominion*

By W. A. McLEAN
Engineer of Highways, Province of Ontario, Canada

In its essentials, the development of roads in Canada has been similar to that in all countries. Canada has had (1) a period of toll roads, prior to 1850; (2) a period of railroad construction, during which road building was neglected; (3) a period of bicycle influence and agitation, in which educational measures and some road organizations were inaugurated, and (4) the period of motor vehicle influence, which has finally brought about a recognition of the necessity for good roads for national development and prosperity, the cost to be borne not by part of the community—that part residing on farms—but by everyone.

Provincial Organization.—A Canadian province corresponds to a state in the United States, the Dominion of Canada being a federation of nine provinces, each with its own legislature. Municipal organization is within the scope of the provincial legislature. The dominion administration up to the present has done nothing for roads, the control of which is vested, primarily, in the local municipalities within which they lie. Every province, however, has a provincial highway department, these departments in the different provinces having varying degrees of influence and authority in road improvement.

In nearly all countries roads are divided into three classes, as follows: (1) Main roads, between towns and cities; (2) leading farm roads, radiating from market centers and shipping points, and (3) local feeders.

The natural features of any country have very largely determined which of these classes has received attention first. For instance, in British Columbia, crossed by the Rocky Mountains and having rich resources of mines and forests, the construction of main roads has been a feature of the provincial road program, upon which there has recently been expended about $15,000,000. In the prairie provinces of Saskatchewan, Alberta and Manitoba, which are principally agricultural and have very little road material, the prevailing roads are earth, and the grader and the log drag up to the present have been the principal means of improvement. The annual expenditure in these two provinces amounts to about $2,500,000.

The Province of Quebec is making a special expenditure of $15,000,000 on road improvement. A portion is being granted as aid to local work, but, in addition, a considerable mileage of main road has been built. On the system of trunk roads in the province nearly $4,000,000 has been spent by the province. A feature of the aid to municipal construction is that for substantial improvement the government provides the necessary capital, charging the municipality 2 per cent. for a term of 41 years, the government meeting the balance of interest and sinking fund. To the present, about $8,000,000 has been appropriated.

Prince Edward Island, a small agricultural province, is concerned principally with earth road work, done under the direction of the provincial department.

New Brunswick as yet is making no large expenditures.

Nova Scotia is not in position to make large expenditures, but excellent progress is being made by the provincial department with the funds available, especially in the improvement of earth roads and the building of permanent bridges and culverts.

Organization in Ontario.—Ontario is the leading province of the dominion, having every variety of territory and resource. Southern Ontario, in which, in an area of about 40,000 sq. miles, there is a population of about 2,500,000 about equally divided between the cities and the country, is probably the most densely occupied portion of Canada. In the southern portion, which is chiefly agricultural, over $2,000,000 is spent annually on road work in the country. The province spends about $1,500,000 annually in subsidies for leading market and main roads in Southern Ontario, for trunk colonization roads in Northern Ontario and minor colonization roads in Northern Ontario.

No part of Canada is so favorably situated to finance the building of main roads as are some parts of the United States—such states, for instance, as Massachusetts, Connecticut or New Jersey, which are small in area and contain numerous cities which contribute to the cost of country roads. Unfortunately, the system of municipal organization in Canada has been such that cities are wholly separated from the counties and townships in which they are situated and have escaped taxation for country roads. Recent legislation has sought to correct this situation, and provision is being made for city contribution to the cost of main roads within reasonable suburban areas.

County Roads in Ontario.—Because of the strong claims of agricultural communities, provincial assistance to the better class of construction has been largely confined to subsidies for leading market roads in each county. Ontario has both township and county organization, township councils primarily having control of all roads. The county council, however, is authorized to take over from the townships leading roads of the county for construction and maintenance. Up to this time, the provincial government has paid one-third of the cost of construction for these roads, but under laws passed this year will hereafter contribute 40 per cent. of the construction cost and 20 per cent. of the maintenance cost. Over one-half of the counties are operating under this plan with good results, over $6,000,000 having been spent on the work to date. It is expected that, in view of the increased subsidy, the remainder of the province will shortly adopt the county system. Property along the improved roads has advanced in value from 10 to 40 per cent. Construction is carried on under an engineer or superintendent appointed by the county council, but is subject to the regulation and inspection of the Provincial Department of Highways.

County councils may issue 30-year bonds to meet their proportions of the cost, but the bonds more commonly are for 20 years. The county system usually includes about 200 miles, or 15 per cent. of the total county road mileage. The roads are largely for moderate farm traffic and are of gravel or broken stone, single track except near cities, and cost from $2,000 to $8,000 per mile. The county subsidy of 40 per cent. is paid on heavy machinery and permanent bridges as well as upon road construction proper.

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*Abstracted.

Bond issues for county roads are met on the annuity installment plan, the sinking fund method having been almost entirely abandoned except in the larger cities.

Main Roads in Ontario.—Under the new legislation for main roads, more attention will be given to the development of certain trunk lines. These include a road between Ottawa and Windsor, a distance of about 500 miles; a branch, 75 miles in length, to the Quebec boundary, and another from Hamilton to Niagara Falls, a distance of 45 miles. The most important section of the latter, about 36 miles, between Toronto and Hamilton, is now being paved with an 18-ft. concrete pavement with 4 per cent. grades. This road will cost about $800,000 and will be completed in 1916.

The administration of roads of this kind is somewhat unusual. A main road is considered to be one connecting two important terminal points or cities and passing through a series of municipalities. Such a series of municipalities may petition the provincial government for construction as a main road. If the petition is indorsed by three-fourths of the municipalities affected, the government makes surveys, prepares specifications and appoints a special board of commissioners to control the construction and maintenance of the road.

This plan of having a local commission for each main road is doubtless weak in one respect, in that one permanent commission for the entire province would bring greater experience and knowledge to each successive undertaking. On the other hand, the municipalities pay the greater part of the cost, and they have and are accustomed to good local self-government. When a series of main roads has been constructed, the tendency will doubtless be to unite them for maintenance under one commission.

Classification in Ontario.—From the foregoing, it is seen that in Ontario the three-fold classification so desirable in road organization is being evolved as follows:

(1) Main or trunk roads, to be constructed and maintained by special commissions under the guidance of the provincial highway department, the cost to be met by provincial subsidy and direct assessment on local units benefited; (2) leading roads, to be under the control of county councils, subject to the regulations and inspection of the provincial authorities, the cost to be met by provincial subsidy and county levy on all assessable property within the county; (3) local feeders, to be under the control of township councils, the cost to be met by the townships.

A Permanent Executive Staff.—A difference between Canadian and American methods with which the writer has frequently been impressed is the Canadian tendency to longer tenure of office. In American states a complete change of executive staff very often follows a change of government. This political influence is no doubt recognized and its abolishment desired by the mass of your citizens. Under representative party government, party influence cannot be wholly eliminated and need not be if it is clean and sane. There is probably no important highway department in the world which is wholly free from politics, but the party which does not recognize the necessity of a permanent executive force is blind as much to its own interest as to the public good. The difficulty appears to be a failure in the American organization to distinguish between "political" and "executive" responsibility—the one to frame and determine the policy, the other to carry out that policy. The purely political head of a department is a part of and properly changes when the administration changes. The executive head and staff, however, should be permanent if reasonable efficiency is to be secured. A permanent executive force, appointed "for life and good conduct," is the only means by which skill, experience and knowledge of local conditions can be secured. A feature of even the purely municipal road systems of Ontario is the endeavor to secure and retain permanent and, therefore, experienced men. Public opinion in the United States would do well to insist on the building up of a permanent executive force in every branch of highway work.

What Good Roads Will Mean to the Dominion.—What good roads will mean of advantage to Canada is readily applicable to the United States. There are 250,000 miles of graded road in Canada. Road building is a slow process, and in most countries it has taken at least half a century to provide adequate surface construction. The immediate objective in Canada should be the substantial improvement of about 16 per cent. of all the roads, or 40,000 miles, carrying the more concentrated market or farm traffic, and the treatment of about 2 per cent. additional, or 5,000 miles, on a trunk road basis. The total cost may be estimated at approximately $250,000,000, of which about $50,000,000 has already been spent. The ideal of expenditure for main road improvement, besides small repairs and maintenance, would be about $15,000,000 annually, or about $2 per capita of population.

Saving in Transportation.—Canada is a country of rich and varied resources, but natural resources are valuable only as they are developed. A considerable part of the cost of such development is the cost of transportation. Lessening this cost is a measure of economy, which will produce a large return on the expenditure. The cost of team haulage on this continent is rarely less than 25 cts. per ton-mile, while under the favorable conditions of good roads in Europe the cost is reduced to from 8 to 12 cts. per ton-mile. While the tonnage carried over the Canadian country roads is not readily estimated, railway statistics show that about 60,000,000 tons of freight originating in Canada is carried. Most of this, at one or both ends, must pass over wagon roads, while a considerable amount, consumed locally, passes over the wagon roads without being carried by the railroads. The average wagon haul for farm and natural produce is estimated at from 7 to 8 miles, and it is probable that a moderate assumption for Canada is that a total of not less than 100,000,000 tons passes over the roads with an average haul of 5 miles. If then it is true that good roads would effect a saving of 10 cts. per ton-mile, an adequate road system in Canada would create a profit of $50,000,000 annually on the produce and merchandise now passing over it.

It is a fair estimate that the time lost in traveling over bad roads amounts to twelve working days annually for a man and a team to the average farm. With over 700,000 occupied farms, this waste of time and effort put into road construction would macadamize the leading market roads in ten years.

Natural Progress and Production.—Strength of character is produced in the individual by effort, endurance and achievement, and as a nation is but the grouping of individuals the strength of national character is developed in the same way. Lack of thrift, improvidence and stagnation in the individual are steps toward poverty, failure and distress. The same is true of a nation. The efficient management of national resources is as necessary to the happiness and prosperity of the people as are thrift and industry in the case of the individual. Were this not so, Canada might be content to stand still. Financial conditions created by the war preclude any such course, even were it desirable. An increased production, particularly increased farm production, is essential to the future of Canada. It is self-evident that good roads are necessary to the development of a farming country. Only one-quarter of over 400,000,000 acres of available farm land in Canada is yet occupied, and roads of a "colonization" type will be necessary to make this territory even accessible for productive purposes.

Roads of a better type are necessary for the further development of the land already under cultivation. Good roads increase the profits of the farm, remove the isolation and increase the amenities of farm life, and facilitate the transaction of business. These are among the reasons why good roads are a necessary part of the agricultural machinery for developing the potential agricultural resources of the country. Nothing is left undone by cities and towns to attract population, and if the nation and cities are to reap the advantage of increased farm population and production rural conditions must be made profitable and agreeable to compete with conditions in cities. Moreover, the cities draw new blood from the country, and, from a sociological standpoint, an intelligent, prosperous farming community is a necessary part of the national fabric.

In Northern Canada there are trails which have been used by the Indians for centuries. A little work would make the portages on these trails infinitely less laborious, but the Indians have traveled these routes for years without making these improvements. As we regard the improvidence of the Indians with respect to their trails, so those accustomed to the splendid highways of Great Britain and France look upon the neglected roads of this continent. They consider that only a very wealthy country, improvident of its resources, can make progress under the handicap of bad roads. Those who have bad roads consider good roads an expensive luxury, but those who have the advantage of good roads know that they are a necessity.

The Selection of Types for Road Surfaces*

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Considering the character of traffic at present using many highways outside of cities and the apparent tendency of country road traffic to more closely approach that on the average city street, practically all the established types of pavements are proper for consideration here and the former attitude of considering separately road crusts and street pavements is no longer justified. On the other hand, a liberal interpretation of the topic of this paper seems to limit the discussion to roadway surfacings outside of built-up districts, with perhaps a brief reference to city streets.

In the past, the selection of the surfacing for any specific improvement has too often been made on the basis of "judgment," the reasons for which the local authority making the decision would frequently have found it difficult to set forth convincingly and intelligibly. Convenience, restricted practice or knowledge, prejudice and even more vicious factors have probably entered into the so-called judgment.

Intolerance of and contempt for modern scientific methods have undoubtedly been behind the decisions of some authorities, old both in years and tenure of office, while lack of knowledge and appreciation of scientific methods have been factors in the judgment of younger authorities. Naturally, the old engineer wishes the value of his judgment enhanced by proper recognition, and the novice wishes to gain practical experience from "cut and try" methods. Both are partly right, but the application of judgment and service tests should follow and supplement properly developed scientific methods and should not preclude the development of the latter nor, being recognized and relied upon by those at present prominent in authority, be made to interfere with the proper development of highway engineering along scientific lines. The selection of surfacings should first be approached on scientific lines; the methods so developed should be tested in practice, and, lastly the principles established should be applied with proper knowledge and judgment in each particular case.

Until the underlying principles are more fully developed and accepted, there are two scientific methods of approaching the solution of the problem. By the first, roads are classified, certain well known surfacings are assigned to each class and the individual selection is made with "judgment" and on the basis of experience, taking into account local conditions. By the second method, all the factors involved are properly considered along mathematical lines and the selection then made, taking into consideration that all known types may be available and that only those types are to be eliminated which will naturally be eliminated by the calculations made.

The second method may be said to be a broad and, perhaps, the ultimate development of the first method, and it may be that the exact knowledge necessary for its general use is not yet available. There are many cases, however, in which it could and should be applied, and it is the natural method to use when, under the first method, we come to the selection of a surfacing for use under extremes of traffic. For the present, the first method seems the more generally applicable for country roads. It does not, however, finally solve the problem satisfactorily, though it effects a partial clarification for the final solution by the use of judgment and produces a more substantial basis for such judgment.

The selection of road surfacings should be founded upon the proper consideration of the following factors: First cost; up-keep cost; annual cost; ease of maintenance; infrequency of repair needed; ease and infrequency of cleaning required; resistance to traction; slipperiness; favorableness to travel; sanitariness; noiselessness; local acceptability. The proper consideration of all these is possible by giving, in any specific case, numerical weights to each factor, these to be in accordance with their relative importance in that case. No general table of numerical values can be made up which will be applicable to all conditions, but the table will have to be made up for each case or for each class of cases where conditions are similar within the class. Any addition or change in the value assigned to one of the factors might necessitate a change in the values assigned to the other factors.

The first method suggested comes between the older means of relying wholly on "judgment," and the second method of scientific analysis of the whole problem. In other words, it is a step toward the end and possibly as much of a step as can be taken at present in most cases. The classification of roads and the adoption of certain types of surfacings for each class is simply an attempt to eliminate those surfacings which lie outside the possibilities of the case, but the lines between the classes are by no means hard and fast and two distinct classes exist between which there is, instead of a line, an intermediate class in which the extremes of the two strongly differing classes lie. Probably most of the difficult problems, therefore, will fall within this middle class so that the elimination made possible by classification would not do much toward the simplification of the problem of selection in these cases.

The proper solution of the problem of selecting types of surfacings seems to be one of the most important subjects now inviting the attention of highway engineers, especially now that the economy of proper engineering is so pertinent and the waste of improper selections in the past is so evident. It has been said that "more mistakes have been made and more money wasted by mistaken efforts to construct 'permanent' road surfaces at high first cost than would have been the case had the selection of materials and methods been more widely made with reference to the use of cheaper methods and local materials, and then proper maintenance accorded the results from these." Doubtless the young engineer is constantly tempted to try for the most lasting results even though the first cost be high, but while durable results are desirable, durability should not always be sought at the expense of every other consideration.

In selections based on judgment alone, the prejudices or predilections of the engineer may not be apparent to himself and the economy may be largely a matter of guesswork, but by the proper analysis of the problem and its solution step by step there will be less opportunity for wrong guesses and for prejudice and personal interest to enter into the solution.

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*Abstracted.

Some highway authorities have advocated the adoption of certain surfacings as standard for certain classes of traffic, and undoubtedly a general agreement as to such standards would considerably reduce the labor of selecting a surface for a road known to be within the limits of the traffic conditions properly applicable to that surfacing. Traffic conditions, however, vary greatly and are, therefore, somewhat difficult of classification. Even were some classification fairly generally agreed upon, is not the general adoption of this standard for any such classification impracticable because of the necessity of considering in every case other factors than the traffic factors? It appears hardly practicable to establish a reasonable number of classifications so as to provide for their ready use and the application of the standards. The demand for standardization for certain classes of traffic apparently arises from a recognition of the insufficiency of "judgment" alone and may be interpreted as a step, taken more or less blindly and unconsciously, toward such a scientific solution as has been suggested.

The scientific method outlined has been criticised as a long step toward resolving highway engineering into a mere application of formulae, but such criticism seems to have proceeded, at least in some cases, from a limited knowledge of the principles involved or the practice in other professions and possibly in some cases from a disinclination for the necessary effort to a proper understanding and application of such formulae when once established.

Some engineers and others of considerable standing have advocated a standardization of various types of pavements for given traffic conditions, considered with one or more of the other factors involved. It is believed that these men are headed in the right direction, but it is feared that their statements may be misinterpreted into the conclusion that this is the final step and that the goal will have been reached when such standards are agreed upon. It is believed that this would be most unfortunate and would bring about just the condition which has been deprecated, that is, the raising of a difficult barrier to the final goal—the scientific solution of the problem in each particular case. While it is admitted that it is quite probable that this preliminary step is all that can be taken until exact knowledge of highway engineering is further advanced than at present, it is believed that advances in knowledge can be made by proper attention to the matter and through proper cooperation among highway engineers. This cooperation must include not only attention to the problem but also the publication of individual ideas and experiences and, further, the wide discussion of both.

Improved Granite Pavements

In this paper Henry Welles Durham, formerly Chief Engineer of Highways of the Borough of Manhattan, New York City, discusses at considerable length the history and development of the improved granite block pavement and reviews practice in several European countries and Great Britain, discusses present practice in this country and describes in some detail the work in granite block pavement done during his term as Chief Engineer of Highways in the Borough of Manhattan.

Early in the paper Mr. Durham points out that until the invention of the road roller, which made possible the construction of pavements in which broken stone is the aggregate, street or road surfaces, from the earliest days of civilization, when improved in any way were composed of cobbles or of more or less regular stone blocks. He then points out that the expression "improved granite pavements" does not refer to any recently discovered new method of constructing superior pavements of that character but merely describes those stone pavements suitable for present-day traffic conditions, as opposed to makeshifts which have been used in American cities and which unfortunately are most frequently thought of by the average citizen when the terms "stone block" or "granite" pavement are used. Until well into the latter half of the past century, according to Mr. Durham, the only type of stone pavement employed in this country was that composed of cobbles. Later, pavements of different types of squared stone blocks were introduced. At about the time sheet asphalt pavements were gaining popularity in 1890, the oblong granite blocks laid transversely to the axis of the road, with joints filled with tar and gravel, came into general use under the designation of "Belgian Block."

After this, very little improvement was made for many years, and until about 1909 it was popularly supposed in this country that stone pavements were of an inferior type. The result of this and the growth in popularity of other pavements led gradually to the cessation of the construction of new stone block pavements, with the result that there was no market for the surplus product of the quarries. As an outgrowth of this situation and at the instance of paving engineers in such cities as Newark, N. J., and Worcester, Mass., and later New York, some of the more enterprising producers of granite commenced the production of more accurately shaped paving blocks. Mr. Durham states that while it cannot yet be said that we have reached the condition where paving blocks are turned out equal to the best abroad, yet considering the very high cost of labor in this country we have succeeded in producing blocks which can make pavements that can be compared favorably with the foreign type, and it is in this sense that the term "improved granite pavements" is used to refer to those which have been used here during the past six years.

Mr. Durham then reviews at considerable length the situation covering stone block pavements in Europe. He points out that in European practice the materials most generally used for highway surfaces, either in the country or in the city, are macadam and stone block. In Paris and Berlin more than 50 per cent. of the street area is paved with stone block, in Vienna nearly 50 per cent. and in the large German cities ranging from 500,000 to 1,000,000 in population the percentage ranges from 40 to 80 per cent. In the 76 leading cities of Germany, containing one-fourth of the total population, considerably more than 50 per cent. of the entire paved area is of stone, while similar cities in Belgium are almost exclusively paved with stone. The percentage in the large French cities varies from 25 to 100, while London, whose paved area exceeds the total paved area in the next three continental cities—Paris, Berlin and Vienna—has about 20 per cent. of stone paved streets. In British cities of the second class the percentage varies from about 15 in Birmingham to over 60 in Liverpool. In none of them, according to Mr. Durham, with the exception of small areas of extremely expensive dressed blocks, are their better stone streets superior to our best. Their average, however, is undoubtedly ahead of ours, and there is no such extent of rough riding, turtle-backed, wide-jointed stone streets as can be found in New York or Boston, for example.

Mr. Durham then describes at considerable length the classification of European stone pavements (1) in accordance with the shape of the stone employed, (2) in accordance with the method employed, (3) in accordance with the care used in dressing the head surface, (4) in accordance with the form of foundation adopted and (5) in accordance with the kind of stone employed.

Study of the specifications under which the material for European stone pavements is bought and the work done, Mr. Durham states, reveals very little variation in practice. The material is described, the allowable variations and dimensions given and the methods of construction stipulated.

It is generally considered sufficient to specify the stone by name or by the district in which it is to be quarried, and after construction, whether by the city forces or by contract, the stone surfaced roads are almost entirely maintained by city labor, as is the practice in this country. Mr. Durham then gives extracts from the granite block specifications of Liverpool, England, Glasgow, Scotland, Lille, France, and Hamburg, Germany. These specifications, Mr. Durham states, show that no definite division exists between improved stone pavements but that all stone pavements belong to several recognized types adopted in accordance with local conditions and that the type of stone employed depends very largely on existing economic conditions and not on any scientific studies as to quality of materials. The matter of foundation, he states, is based entirely on local conditions, while the shape of the blocks has become largely standardized. In spite of assertions that have been made in this country to the contrary, no definite opinion exists abroad unanimously in favor of either bituminous or hydraulic cement grouted joints.

In this country, according to Mr. Durham, conditions are very different, and there is no possibility of any such classification as has been described as obtaining in European countries. The classification, in accordance with quality, can be made as (1) modern improved granite pavements, (2) a small amount of satisfactory basalt, sandstone and limestone pavements and (3) a great majority of inferior stone pavements of all types. It would also be useless to attempt a classification based on the shapes of the stone employed. In regard to a classification on a basis of foundation employed, there is less variation possible here because of the conditions under which our streets and roads have been constructed.

. The evolution of stone block pavements in this country, which has led up to our present improved pavements, according to Mr. Durham, is merely a rather sudden divergence from our former careless, slipshod practice to the standardized methods of Europe, with the added study necessarily given by those charged with building in a few years an amount of pavement built in European cities over long periods of time. The desirable features of an improved stone pavement are given by Mr. Durham, essentially, as follows: First, a concrete foundation; second, rectangular blocks of standardized size, laid at right angles to the axis of the road in close contact and laid on a layer of sand or gravel resting on the concrete in order to correct irregularities in the depth and with joints filled with cement grout or a bituminous mastic with which is mixed sufficient mineral aggregate to give it proper body.

The kind of stone suitable for paving blocks, according to Mr. Durham, has developed more debate and difference of opinion than any other subject connected with modern stone pavement. In discussing this he says:

> The American mind possesses almost childlike belief in the efficacy of words, and the average public spirited citizen or responsible official charged with road construction has come to believe that the best specification must of necessity be most complicated. Because we are able to define with great precision in specifications the physical and chemical qualities desired in many manufactured products, the mistaken idea has arisen that the same thing can be done for the products of nature. Properly written specifications must take account of this distinction. Where a definite process is to be adopted, it is possible to describe in detail the methods by which this process is to be carried out. Where a natural product is to be used, however, it is hardly possible to describe an arbitrary list of physical and chemical qualities which will define absolutely the best material desired, and where this is attempted the result is usually either to produce what is known as closed specifications, admitting only some favored product, while others equally satisfactory are arbitrarily ruled out, or to evolve an utterly useless series of definitions which have no real bearing on the merits of the result desired.

This question, according to Mr. Durham, has assumed importance only since the introduction of the improved granite block pavement, it being taken for granted previously that any available stone which could be broken into blocks approximately rectangular in shape would do for a stone pavement. The attempt which has been made to standardize stone specifications on a plane with those employed for other types of surface is undoubtedly desirable in that it places a limit between satisfactory and unsatisfactory material. The economic question, however, must be considered at the same time, as it is useless to prescribe qualities which cannot be met by stone in quantities or at a price to compete with others equally satisfactory. Mr. Durham points out that it is a mistake to assume that the standard tests for determining the suitability of rock to be used in macadam construction are applicable to stone for use in a quite different manner. He also points out that the qualities prescribed by these tests are not intended to be applied by any hard and fast rule but must be considered in the light of local and other conditions.

The remainder of Mr. Durham's paper deals with work with stone block pavements in Manhattan during Borough President McAneny's administration, during which time Mr. Durham was Chief Engineer of Highways of the Borough of Manhattan. During Mr. McAneny's term of office, Mr. Durham states, there was repaved under Mr. McAneny's direction over 25 miles of heavily traveled streets with carefully dressed, close-jointed granite blocks. At the beginning of the work, according to Dr. Durham, it was argued that the specifications include the various tests previously alluded to, without which, it was claimed, the results common in European practice could not be obtained. It was Mr. Durham's opinion that before prescribing these tests it was desirable to ascertain whether they had been used elsewhere and, if so, what was the quality of the material supplied. In accordance with this policy, investigations were made of the available sources of supply of stone paving blocks for New York City and vicinity, and it was found that the quarries in foreign countries could not compete on equal terms with quarries in this country, and also that there were enough quarries producing stone in this country to render unnecessary any attempt to obtain stone elsewhere.

Mr. Durham also describes briefly the construction of sections of stone block pavement laid with granite and sandstone in the series of test pavements laid on Second Avenue, and states that after three years' service the granite has shown no appreciable wear, while the sandstone shows a minimum wear of about ⅛ in. Having ascertained the possibility of securing stone from various American quarries, a series of tests was undertaken during 1912-13 on samples furnished by the quarries and on samples taken from blocks which had seen actual service for various periods of time. All samples were subjected to tests for ultimate compression, hardness or resistance to abrasion, toughness or resistance to impact and the Deval test for resistance to wear. In addition, in order to obtain data on European practice, Mr. Durham, at the request of Borough President McAneny, was appointed by Mayor Gaynor to attend the Third International Road Congress at London and to study street pavements abroad. This study was conducted during the year 1913, and as a result it was found that practically no physical test for materials for stone block pavements was conducted in any of the important cities of Europe. Some of the cities and quarries had information as to certain tests which had been made on their materials, but contracts were not made specifying that the materials should conform to tests of the character just classified. Great differences of opinion were also found as to the desirability of using materials showing the highest results under these tests. It was also discovered that among European engineers, as among the engineers of America, there exists a great lack of information as to the term "hardness" and its value as a quality for paving material.

Mr. Durham then summarizes the results of the experiments conducted by him, and states that they illustrated very clearly the lack of any value to be attached to the test for ultimate compression; that in the test for hardness or resistance to abrasion the variations between different samples are negligible for all practical purposes; that in the test for toughness or resistance to impact there is only a slight range in products of American quarries commercially available for streets, and that the results of the Deval test showed no decided variations among the American quarries. In Mr. Durham's opinion, it is inadvisable to fix any arbitrary testing standards until more experiments have been conducted, not only in the laboratory but in service.

In conclusion, Mr. Durham states that in the improved granite pavement we have a type which can take its place in one of the few approved classes of modern road construction. He points out that whether a road is to be constructed of sand or stone held together by cementing materials, of blocks manufactured in various ways or of blocks shaped from stone is an engineering question. Under the limitations enumerated, where the choice depends on a combination of qualities of extreme durability for heavy motor traffic and availability for horse-drawn vehicles, granite block will always be a strong bidder for favor. He states also that such a pavement will be satisfactory, in this country at least, only when it complies with the specifications noted, being constructed on an adequate foundation, which should in almost all cases be of concrete, with blocks accurately dressed to a rectangular shape, of minimum variation in sizes and with faces so nearly plane as to permit the laying of joints not to exceed ⅜ in. in width and finally having the joints filled with such material as will remain flush with the top surface. Whether this should be Portland cement grout or some form of tar or asphalt with sand will depend upon local conditions.

The Organization of Highway Departments and the Use of Planning Boards to Simplify the Operations

In this paper William H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pa., discusses at considerable length the organization of highway departments, with especial reference to city street departments, and describes in considerable detail the planning boards used in his own work. A description of the planning boards was printed in "Good Roads" for September 11, 1915, and was there treated at greater length than would be possible here. ["Planning Boards Installed in the Bureau of Highways and Street Cleaning, Philadelphia, Pennsylvania," by Wm. H. Connell, "Good Roads," September 11, 1915, page 168.]

Mr. Connell's paper is very complete, and the available space permits in the following paragraphs reference to only a few of the most important points brought out by him.

Early in his paper Mr. Connell suggests the following definition of highway organization: "The combination of correlated integral parts into a whole to systematize and simplify the operations, and bring about a maximum of efficiency in the service rendered with a minimum of friction." One of the first points made by Mr. Connell is that the combination of the correlated integral parts into the whole should be a logical arrangement of the principal functions and not an arrangement to suit the personnel unless such an arrangement is necessitated through force of circumstances or is only temporary. There are many instances where certain functions are grouped together for the sake of putting them under the jurisdiction of an individual who is qualified to handle the work. This, Mr. Connell states, is contrary to the fundamental principle of organization and is the poorest kind of logic. The organization should be planned and the work systematized in such a manner that it will not be dependent on any one individual.

The controlling factors of highway engineering organizations, according to Mr. Connell, can be classed as preliminary studies and the organization of an operating department. The preliminary studies include (1) scope and character of work, (2) area under control and (3) population and how apportioned. The organization of an operating department includes (1) planning of the organization, (2) selection of the personnel, (3) administrative control, (4) division of responsibility, (5) systematizing the work and (6) methods of operation. Each of these subdivisions of the two classes is taken up and treated in detail in Mr. Connell's paper. Under the first—scope and character of work—he lists the work that should come under the direction of a municipal highway department, a state highway department, a county highway department and a township highway department. In considering the second—area under control—it is pointed out that this is a very important factor not only in planning an organization but in selecting the types of pavements and the methods of construction. Note is also made that it is desirable to centralize the control as much as possible but that as the area increases the authority must be delegated.

Under the heading "Planning the Organization," Mr. Connell points out that no matter how able the personnel, ease of operation and economy and efficiency in controlling different branches of work will vary with the character of organization. It is further stated that the difficulties to be surmounted depend largely upon whether the problem consists of planning an organization for a new department or, as is more frequently the case, reorganization of an existing department, the latter being the far more intricate problem. It is stated that the organization must be planned with a view to the future, having in mind the passage of whatever legislation is necessary to put the department on a thorough business basis. At the same time, it is far better to turn out the work under what may not be an ideal organization than to hold up work pending the passage of required laws.

In selecting the personnel, all members of the staff, other than those of the clerical, stenographic, audit and accounts, and purchasing divisions, should be men of technical training and experienced in highway engineering, with the exception of those who are to serve as inspectors, for which position men experienced in road building are qualified. In large organizations the selection of the personnel is one of the most important factors and, in many localities, is becoming one of the most difficult because of the methods employed by some civil service commissions in determining the qualifications required for the selection of candidates for the higher positions where personality, broad experience in controlling work and good, sound business judgment should be the primary considerations. The principles of civil service, which are intended to safeguard the interests of the public and do away with the "spoils" system, should be construed in a sufficiently broad manner to permit heads of departments to command control of the work, and this can be done only through a broad application of the civil service laws in regard to the selection of division heads in large departments. The qualifications for successful division heads vary with the character and scope of the work to be done, and just because a man is a good highway engineer it does not necessarily follow that he will be a success. Personality and business judgment have as much weight as engineering ability. The right kind of a man for such a position should not be lacking in imagination and should possess the faculty of not only commanding the respect of his subordinates but should also be able to secure their good will, and this means that he must establish a sort of "esprit de corps" in the organization. "A man who operates through the good will of his subordinates accomplishes far more than the stern disciplinarian who lacks the good will and is feared by them. This is especially true in government, state or municipal work, where the civil service laws and other considerations minimize the authority of the department heads."

In discussing administrative control, Mr. Connell states that the control should be vested in one man, who, whatever his title may be, should be a highway engineer having executive ability and versed in the principles of management. It is a great mistake, according to Mr. Connell, to put such work under a commission of three or more men, as is the case in many states, counties and townships, for it is perfectly obvious that better results can be accomplished and that they can be accomplished much quicker by a single administrative head than through a commission.

There is nothing more important in any organization, according to Mr. Connell, than the fixing of responsibility for different parts of the work. It is pointed out that it is a great mistake for anyone to attempt to carry too much on his own shoulders but that this is nevertheless a common fault. No large undertaking can be operated smoothly and no organization can be successful unless each employee is trained to carry on his part of the work and to accept responsibility for so doing.

Systematizing the work, according to Mr. Connell's paper, requires a very careful study of all the activities of the department and their relation to one another, as the primary consideration should be to do away with as much unnecessary routine as is possible and still have an adequate system of control. Maintenance and construction work should not be under separate organizations, it is stated, as such a practice results in an overlapping of jurisdiction and a tendency to shift responsibility.

It is held, further, that it is obvious that the logical organization to maintain pavements is the one that saw them laid and is familiar with every detail of the construction. "Highway engineering may be considered a specialty, but further specializing in construction and maintenance is not logical as the two are dovetailed and cannot be considered separately."

The Merits of Natural Asphalt Roads*

By CLIFFORD RICHARDSON

Consulting Engineer, Barber Asphalt Paving Co.

The merits of any type of road surface depend upon the design, the skill employed in construction, foundation, drainage, character of the materials and the method of construction. The merits of any bituminous material used are determined eventually by service tests extending until the life of the road surface has been demonstrated. The merits of the bituminous material may also be inferred by a study of the physical properties of the bitumen and of the bitumen combined with suitable mineral aggregates. Natural asphalts—the particular materials assigned as the subject of this paper—are, with the exception of gilsonite and grahamite, the only more or less solid bitumens occurring in nature which are of commercial importance. They are obtained from the so-called lakes on the Island of Trinidad and in Venezuela, and are used in various types of road surfaces. The merits of Trinidad asphalt have been demonstrated by service tests extending over nearly forty years. It is a material containing a very uniform percentage of very finely divided mineral matter, a considerable proportion of which is clay is a highly dispersed colloidal condition. Bermudez asphalt is a much purer bitumen, and because of its convenience in handling is more readily used in the construction of broken stone surfaces.

Natural asphalt was first employed in the construction of monolithic street surfaces with sand aggregate about forty years ago. The success of this work and improvements in methods of construction introduced about twenty years ago led to the use of the material as a binder for broken stone country roads.

The merits of natural asphalt for building broken stone roads have been demonstrated in Massachusetts perhaps more thoroughly than any other locality. The first broken stone surface in which natural asphalt was used as a binder was laid on Western Avenue, Gloucester, in 1909.

Two methods of construction are in common use for the construction of asphaltic broken stone roads. In one—the mixing method—the stone is coated with asphalt before it is placed on the road, and in the other—the penetration method—the stone is spread and the asphalt subsequently applied. In Massachusetts natural asphalts have been used by both methods. During recent years the penetration method has been preferred for reasons which seem satisfactory to local engineers, among these reasons being the availability of mechanical distributors. It might seem at first that the careful mixing of dry stone and cementing material could be more readily accomplished by the mixing method, and this is true to a certain extent. But the stone, especially if hot when mixed, will carry a film of bitumen of only a certain degree of thickness. Any excess will run off, especially if the binder lacks viscosity when melted. By the penetration method, on the other hand, a larger amount of bitumen can be introduced into a road surface, if it is sufficiently viscous in a melted condition to remain well distributed. This enriches the surface to a degree impossible by the mixing method.

A Massachusetts engineer of extended experience has said: "Under certain conditions the penetration method, using a natural asphalt binder, will produce roads fully as satisfactory as are obtainable with the mixing method, if proper attention is given to construction details." This is the opinion of one who has had experience with both methods, using natural asphalts, and his conclusions are the results of service tests of roads of both kinds. These conclusions do not agree with those of some engineers who have based their conclusions on the use of less viscous materials which are so liquid that they will not stay in place.

In the construction of asphaltic broken stone surfacings by the penetration method, it has been demonstrated, especially by the writer's observations in Massachusetts and on Long Island, that the size of the stone is of great importance and that it should be as large as 2½ ins. Such stone gives greater stability than smaller material and permits a more satisfactory introduction of the binding material. Moreover, it can be used satisfactorily by the pentration method, but not by the mixing method, on account of the difficulty of handling large stone in mechanical mixers.

Massachusetts experience has also shown that the more viscous natural asphalts can be used in larger amounts per square yard of surface than can less viscous asphalts which are more susceptible to temperature and would be drawn to the surface by the sun if used in larger quantities. Based upon Massachusetts experience, the amount of natural asphalt used should be 1 gal. per in. thickness of stone, aside from that employed in the seal coat. Such a road is rich in bitumen, possesses greater resiliency and is more resistant to wear.

Another strong argument in favor of the penetration method is that the cost of construction is from $3.000 to $4,000 per mile less than by the mixing method. This not only saves in first cost, but also an interest charge of from $150 to $200 per year.

In considering, therefore, the relative values of the mixing and the penetration methods, when natural asphalts are used, the following advantages in favor of the penetration method must be borne in mind: (1) Larger stones can be used in the penetration method than in the mixing method;

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*Abstracted.

(2) a more elaborate and extensive plant is required for the mixing method than for the penetration method; (3) the penetration method allows the use of a greater quantity of binder, which acts as a reservoir for the enrichment of the surface; (4) natural asphalts when present in some excess are not susceptible to high temperatures and the road does not bleed.

Evidence favoring construction with natural asphalts by the penetration method is well presented in two recent articles—"The Comparative Value of Penetration Roads," by D. T. Pierce, "Good Roads," November 6, 1915, and "Bituminous Penetration Roads in Massachusetts Equal Those Built by the Mixing Method," "Engineering Record," May 15, 1915.

In the United States sheet asphalt has rarely been used in surfacing roads, but its suitability for this purpose has been recognized in England for main highways carrying heavy traffic. As time elapses and funds become available, it will, no doubt, be adopted here. In England the surface is laid on a close binder, supported by excellent old macadam surfaces which form satisfactory foundations.

Stone filled asphalt surface mixture, laid with natural asphalts as binders, and sometimes called asphaltic concrete or Topeka mixture, is a highly satisfactory surface even for heavy travel. It consists of a standard sheet asphalt surface mixture, combined with broken stone less than ½ in. in diameter and having an amount of surface mixture more than sufficient to fill the voids in the stone. The success of this construction depends upon the care exercised in the grading of the finer portions of the aggregate. To any standard sheet asphalt mixture, stone of pea size is added with sufficient additional bitumen to cover the surface of the stone. The merits of this material lie in its economy, since, owing to the presence of the stone, a smaller percentage of the bitumen is required. In such a place as Riverside Drive in New York City, this type has withstood heavy motor-bus travel satisfactorily and seems to have a considerable future before it where proper materials are available for the aggregate.

The merits of natural asphalt roads, aside from their durability, are those common to all smooth surfaces, with the addition that, when properly constructed, their maintenance can be readily carried out with simple appliances.

It may be said, in conclusion, that the value of any material or form of construction can be demonstrated only by service tests. Experience and the actual financial return for the travel carried are the sole criteria upon which to judge any road surface.

The Merits of Refined Asphalt Roads*

BY LEROY M. LAW
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The subject, "The Merits of Refined Asphalt Roads," would hardly have been a welcome assignment five years ago, and, in fact, any discussion along such lines would have had to be of a prospective nature, and of little promise, for most service experiences had proven failures and an inadequate chemistry offered little ground for optimistic predictions from the laboratory standpoint.

The "Merits of Refined Asphalt Roads" resolves itself into the merits of the asphalts used, for in the same type of construction the other factors will be practically the same for all asphalts.

The evolution of any product depends upon two factors—raw materials and process of manufacture. Petroleum doubtless entered the paving industry as a flux or softening agency for the solid native bitumens which were too hard to use in their natural conditions. These fluxes were not straight mineral oils but the residue or by-products of the distillation of petroleum to secure burning oils and, later on, gasolines and lubricants. The fluxes were what remained in the still and, under the name of "residuum," were generally considered to contain the lubricating oils, waxes and pitch base. That they were refuse products is shown by the fact that oils were frequently subjected to the so-called cracking process for an increase over the normal yield of burning oils, this being done to the detriment of the residuum.

There are about six oil fields in this country, and though the oils in some of them vary from well to well they were practically all distilled for the same major products. It was not surprising, therefore, that the residues were variable and sometimes unsuited even for fluxes.

The increasing use of the more successful native bitumens early became the stimulus for the development of the residuals so that they might compete with the asphalts, and to do so it was necessary that they be brought from their more or less fluid state to consistencies suitable for paving purposes. It was early found that distilling paraffin and semi-asphaltic petroleum beyond the "residuum" stage resulted in the decomposition of the pitch or asphalt residues to such an extent that they could not be seriously considered as paving materials, so other means were sought to achieve the desired end. It was found by Dubbs that adding sulphur to the residuum, maintained at elevated temperatures, resulted in a molecular condensation with the liberation of sulphuretted hydrogen gas. The resulting artificial asphalts were called "Pittsburgh flux." At about the same time, Byerly found that blowing air through heated residuum accomplished similar results, and in 1893 took out a patent covering the air blowing process. This proved a most important step as air blowing was cheaper than the sulphur process, and by regulating the duration of the "blow" asphalts of varying consistency could be produced. Materials produced by this process have proved successful, though they made no serious inroads on native bitumens for paving purposes.

Another step in the evolution of asphalts from petroleum was taken by compounding with the distillation residues hard bitumens like gilsonite and grahamite so as to produce materials of paving consistencies. Many of these compounds contained as much oil as hard bitumen, and the air blowing process was frequently involved in their manufacture. Several rather successful asphalts of this character have appeared on the market in recent years. Because of the large percentage of oil residuum required, the character of the finished product is uncertain, and this, together with the high price of gilsonite and grahamite and other factors, doubtless served to restrict the use of such preparations.

This brings us up to about 1900, previous to which oil asphalts were purely artificial materials, being, at best, prepared from oils of low asphaltic content and their solidity and consistency depending upon the method of manufacture. It was probably only to be expected that they would be called by such names as manufactured asphalts, oil asphalts, residual asphalts and the like, though such designations are not appropriate to the totally different types that followed.

Asphalts from Texas and California petroleums next deserve attention, and it is interesting to note that while they differ widely in characteristics both are still in use. The original Texas asphalts, being blown, were low in susceptibility to temperature changes but their low ductility retarded their adoption where specifications called for a minimum ductility of from 15 to 20 centimeters. California materials, on the other hand, possessed practically unlimited ductility, for, being obtained from full asphaltic base oils, the blowing process could be omitted. This fact renders their advent the turning point in the evolution of petroleum asphalts, as they could be prepared by a simple refinement direct to the desired consistency. Although there has been some lack of uniformity in the crude supplies and their high susceptibility has sometimes been considered objectionable, they have been quite successful and are still in use.

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*Abstracted.

The ideal raw material for the production of petroleum asphalts became available about five years ago, when the Mexican petroleum entered the field. The material was ideal because the asphalts produced met successfully recognized tests and the supply was plentiful and uniform. These asphalts had appeared in the paving industry years ago, but the earlier oils were more or less solidified effusions from the real supply, which lay thousands of feet below the surface. The opening of several large wells on the east coast of Mexico in 1910 marked the beginning of a new epoch in the asphalt business, as a large supply and reasonable water transportation rates soon made it possible to market the material at a favorable price.

The two types of Mexican petroleum brought to this country are in general a heavy oil of from 10 to 12° Be. gravity, carrying about 70 per cent. of asphalt, and another of 18 to 21° Be. gravity, carrying from 55 to 60 per cent. of asphalt. These come from wells 3,000 to 5,000 ft. deep, are collected and then pumped into specially constructed tank ships for transportation to the refineries in this country. Both oils yield excellent paving materials. Their high asphalt contents and correspondingly low percentages of light oils permit prompt refinement with a minimum risk of injuring the residues, which in handling the Mexican petroleums are the major products of the refinery. With either type of crude, it is commercially practicable to stop the refining process at any stage of consistency so as to give the engineer a material made by one simple process. By this means the natural fluxes are retained and subsequent artificial fluxing is unnecessary.

For paving cements and road binders there is apparently a preference for the products of the heavier oils, probably because of their greater density and lower paraffin content. The lighter oils, however, serve as the chief source for road surfacing materials. When simply freed from moisture and sediment, they serve as cold surface dressings, while deprived of the lighter oils they serve for the more permanent and so-called hot surface applications. That the merits predicted for the materials by scientific tests have been verified is evidenced by their use in many cities for sheet asphalt and asphaltic concrete. In many cities the pavements have successfully passed into their fourth year of service. The uses of Mexican products have been even more general in road construction and treatment than in street pavement work, as evidenced by work in Maryland, Massachusetts, New York, New Jersey, Pennsylvania, Illinois, Maine, Virginia and New Hampshire and in the Canadian provinces. Such recognition of asphalts from Mexican petroleum show that the early conceptions of "oil asphalts" are fast being obliterated; certainly they indicate that the character of the material itself is to be considered rather than the classification in which the material may be placed. In this connection, attention is called to the decision of the Supreme Court of the State of New York to the effect that asphalts prepared from Mexican petroleum are to be considered in every respect natural asphalts.

With the entry of California materials into the field, the possibility of simplifying the process of preparing petroleum asphalts was noted. This was because the oils themselves were rather fluid asphalts than mere oils. A high asphalt content with a corresponding reduction in the amount of burning oils brought about a complete change of purpose and what had been the "residuum" or residue became the major product. This is the case today in the refinement of Mexican petroleums; every possible care is taken to preserve the asphalt constituents, leaving as the refuse or by-products the volatile oils, which are sold for fuel and gas making purposes. This change has brought forth several new processes, among which may be mentioned those covered by the Dundas and Trumbull patents. The former is little used but the latter is in successful operation for both California and Mexican oils and is worthy of mention. This operation depends upon preheating the oil, then pumping it to the top of heat-jacketed, cylindrical towers and allowing it to run down the inner surface of these in a thin sheet. Around a central vertical standpipe or off-take are openings through which the lighter oils pass to the condensers. The consistency of the asphalt produced is controlled by the temperature employed and the rate of pumping.

The most generally used process is that of steam distillation, which removes the lighter oils from the associated materials at temperatures below their normal boiling points. In this process the petroleum, after the moisture has been removed by settling or other suitable treatment, is charged into stills. Heat is slowly applied and maintained throughout the run but the distillation is actually accomplished by steam vapors. A current of live steam is passed into the heated oil and, issuing from a multitude of fine orifices along the still bottom, carries the light oils with it and the mixed vapors pass into the condensers. These oils would require temperatures as high as 900° or 1,000° F. for actual distillation, but this steaming process removes them at a temperature as low as 600° to 650° F. Agitation due to the passage of the steam also assists by preventing any part of the asphalt from being long in contact with the bottom of the still where the heat is the greatest.

Following the path of its predecessors, it was, perhaps, to be expected that the Mexican products would encounter suspicion, doubt and opposition on entering the paving field. There had been, however, a parallel advance in the science of testing bituminous materials, and it was anticipated that this would go far toward assuring reliability. It did to a very large extent. Otherwise petroleum asphalts would not have attained their present standing. Frequently specifications were deliberately closed to these materials, but, thanks to the chemist, these conditions have been largely eliminated and today the best types of petroleum asphalt are welcomed in open competition with all other good materials.

What the United States Government Is Doing for the Good Roads Movement

Although this paper, as its title implies, deals with a description of the road work of the Office of Public Roads and Rural Engineering, Logan Waller Page, Director of the office, gives considerable space in it to a discussion of the economics of road improvement.

Mr. Page first lists briefly the activities of the office, which comprise the preparation of publications, the making of addresses and exhibits, the construction of object lesson roads, the testing of road materials and field and laboratory experimental work. He then states that the development of the automobile and the concentration of population in the cities are two factors which have made the problem of highway construction and maintenance exceedingly important. Only a few years ago the common means of intercommunication were the railroads, while the highways were merely local conveniences. Horse-drawn traffic seldom found it economical to exceed a radius of from 10 to 15 miles. All this has been changed, he states, by the development of the automobile and the motor truck, and both the dwellers in the cities and the farmers are coming to realize the degree to which roads affect their material welfare.

After describing briefly the part taken by the national government in the improvement of public roads in the early days of the country, the writer sketches briefly the establishment of the Office of Public Roads in 1893 and its development since that time. At first, the work of the office was limited to investigation and the publication of reports. Its activities were gradually widened so as to include the physical and chemical testing of road materials, the conducting of field experiments and the construction and supervision of certain post roads authorized by the appropriation bill of 1912. The work of the office, according to Mr. Page, has been devoted largely to "the improvement, in a broad way, of methods of construction and maintenance, and of the quality of materials used, and to the application of scientific business methods in the management of our public roads." In explanation of the reason for the efforts of the office along these particular lines, Mr. Page reviews at some length the present road situation. He states that the cash expenditure for roads and bridges last year amounted to $249,999,999, while 10 years earlier the total expenditure amounted to slightly under $80,000,000. He states that a conservative estimate would place the waste from the use of improper materials, faulty methods and poor management at at least 20 per cent., and states that any private business, managed with an equal degree of efficiency, would result in bankruptcy.

Another part of this large expenditure, according to Mr. Page, is due to maintenance, and points out that in attempting to build roads of such a character that the maintenance charge will be greatly reduced, too expensive roads have sometimes been the result. He also dwells at some length upon the necessity of considering not only the first cost of a road but also the annual aggregate cost during the life of the improvement, illustrating by examples involving these items.

In this connection, it is pointed out that the period over which the computation is extended should not be unduly prolonged as the traffic changes which have taken place within the past 10 or 15 years should teach us that what will happen in the future cannot be foretold. Road improvement, according to the paper, is a public undertaking, the wisdom of which must be measured by the resulting benefits. It is pointed out that not all road improvements pay dividends and that it is possible to pay too much for a road improvement. A road improvement, to be justifiable, according to the paper, must give reasonable promise of an adequate annual return in social and economic benefits.

Another point which the Office of Public Roads is trying to bring to the full realization of the general public and highway officials, according to Mr. Page, is that the apparently high cost of maintenance in some cases is not so alarming as it would seem, since a large portion of it really represents a combination of deferred or delayed maintenance, proper maintenance and reconstruction.

In closing, it is asserted that there is positive need for centralized control and highly skilled supervision, particularly with reference to the design and construction of highway bridges, the expenditure of large local bond issues, the handling of local highway funds through efficient cost account systems and finally with regard to the qualifications of the men locally selected to carry on the work. The expectation is expressed that in the not far distant future we shall have compact and efficient local organization which will work in harmony with and under the proper supervision of highly trained and skillful highway officials. This central control should be divorced from politics and form a competent whole which from top to bottom should have "efficiency and the public good" for its motto.

Convicts to Build Concrete Bridges in West Virginia

According to a report by A. D. Williams, Chief Road Engineer of the State Road Bureau of West Virginia, convict labor is to be used in the construction of concrete bridges in the state.

Work is to be commenced at once on two reinforced concrete spans, one of which will be an overhead railroad crossing and the other an undergrade crossing. A detail of 25 prisoners will be employed.

Although authorities on the subject of prison labor have held that it is an open question whether convicts can be successfully employed on high grade work, the West Virginia officials are convinced of success. The experiment of employing prisoners on bridge work follows upon the satisfactory experience of the state in the use of convicts in work upon county roads during the past three years.

NEWS NOTES

The Need for Alleys in Cities was argued by Charles B. Ball, Chief Sanitary Inspector of Chicago, Ill., in a recent paper, entitled "The Alley Problem," presented at the Fourth National Conference on Housing in America, held at Minneapolis, Minn. According to Mr. Ball, alleys exist in over two-thirds of the cities in this country and they are provided for in laying out additions to these cities except in a few cases. He also pointed out that provision for alleys has been made in such cities as Washington, D. C., Savannah, Ga., and Vandergrift, Pa., in the laying out of which the most careful consideration was given to the principles of city planning. Among the advantages of alleys, according to Mr. Ball, are that that they facilitate access to the rear of premises for delivering goods and for removing wastes; that they provide for the easy and rapid operation of fire apparatus; that they furnish parking space for vehicles, and that they can be utilized for sewers, water mains and other subsurface structures. It was also pointed out that an alley is required in every city block because only by that means can a sufficient amount of light and air in the middle of the block be assured for the future. This, according to Mr. Ball, is the principal reason for the alley.

Granite Block Pavement on Lower Broadway, New York City, has been Recommended by the Motor Truck Club of America. This recommendation was made in a letter written to Borough President Marcus M. Marks of Manhattan, dated December 11, by President T. D. Pratt of the Motor Truck Club of America, in accordance with a resolution passed at a meeting of the club held in November. According to the letter, it appeared that the prime factor for consideration in determining the character of the pavement put down is the traffic which is to use the street. It is pointed out that the lower portion of Broadway is entirely commercial, that there are no hotels or theaters along it and that it is not used to any extent by pleasure vehicles, being a strictly business street carrying heavy trucking. It is also recommended that the foundation be of concrete, 8 or 10 ins. in thickness, reinforced if the soil beneath it is soft, on top of which should be laid from ½ to 1 in. of gravel or fine stone mixed with a soft mortar of cement and sand. The paving blocks, it is stated, should be laid directly upon this, immediately after it is placed, the blocks being set with a template and grouted with cement grout. The letter also states that the recommendations contained in it apply not only to lower Broadway, but also to all main arteries of traffic.

The Grade Crossing Problem of Dallas, Tex., can best be solved by the construction of a belt line railway, according to a report recently submitted to the Mayor and Commissioners of Dallas by John F. Wallace, consulting engineer, of Chicago and New York. At present the total main line mileage of railroads in the city is between 35 and 36 miles, while the total trackage amounts to a little over 77 miles. On this mileage of track there are 141 grade crossings. It is stated in the report that to eliminate all of these crossings, except some that could reasonably be closed, would cost about $5,000,000, while to protect all the existing grade crossings by watchmen, etc., capitalizing their maintenance, would cost about $3,200,000. The plan proposed is to construct a belt line railroad around the city, intercepting all the railroads now running into the city. On this would be carried all of the traffic except perhaps that to local industries in the business district. For a time these would be served by allowing existing tracks to remain, operating traffic over them under certain restrictions as to speed and hours during which they could be used. New industries would have to occupy sites in certain designated districts, and eventually the tracks within the belt line would be removed and their rights of way used for streets.

The Road Congress at Worcester, Mass.

The meeting known as the "First International Road Congress" was held at Worcester, Mass., on Tuesday, Wednesday, Thursday and Friday, December 14, 15, 16 and 17, 1915. The congress was held under the auspices of the Worcester Chamber of Commerce and with the cooperation of the Massachusetts Highway Association. An exhibition of road building machinery and materials was held in connection with the congress, the exhibits being housed in the Auditorium adjoining the Hotel Bancroft, in which the sessions of the convention were held.

Because of a heavy snowstorm which seriously interfered with the railroads in New England and New York, many of those having places on the program on Tuesday were delayed, with a consequent disturbance of the program. The attendance was also probably adversely affected by the disturbed traffic conditions, which continued throughout most of the week.

The opening session was called to order on Tuesday afternoon by J. Lewis Ellsworth, President of the Worcester Chamber of Commerce and of the congress. President Ellsworth welcomed the delegates, in the course of his address complimenting those who had worked in getting up the congress and paying special tributes to the Massachusetts Highway Association and to Harold Parker, former chairman of the Massachusetts Highway Commission.

At the close of his address of welcome, President Ellsworth introduced Grafton D. Cushing, Lieutenant Governor of Massachusetts, who made the address of welcome on behalf of the state. In the course of his address, Lieutenant Governor Cushing reviewed briefly the history of the Massachusetts Highway Commission from the establishment of the temporary commission in 1893 to the present. He said that Professor N. S. Shaler of Harvard University and William E. McClintock, members of the original commission, and Dr. T. C. Mendenhall, formerly President of the Worcester Polytechnic Institute, were largely responsible for the system which has proved so successful in Massachusetts. Dr. Mendenhall was the second chairman of the commission and was followed, in turn, by Mr. McClintock, Harold Parker and the present chairman, Colonel William D. Sohier. He spoke of the expenditures which had been made for road improvement in Massachusetts, and said that if was safe to say that the state highways, in the condition in which they now are, could not be replaced for the total of their cost and are certainly worth 50 per cent. more than the net debt due for highway purposes. He then went on to describe in some detail the present work of the commission and paid a high tribute to the work of the commission and its staff.

The response to the addresses of welcome was made by Governor Charles W. Gates of Vermont, who previous to his election as Governor served as the State Highway Commissioner of that state. Governor Gates, in a brief address, thanked the President of the congress and the Lieutenant Governor for the welcome extended, spoke briefly of the advantages of good roads, and congratulated Massachusetts on being the leader in the work of highway improvement.

The last speaker of the session was Thomas Cote, Commissioner of Public Works, of Montreal, P. Q., who presented a paper on "Precautions Adopted by Dominion Cities Against Extreme Climatic Changes in Building and Maintaining Streets." This paper was scheduled for Thursday afternoon, but was changed to Tuesday to take the place of the papers of W. A. McLean and Logan Waller Page, who had not reached Worcester.

On Tuesday evening there was an entertainment in the ballroom of the Hotel Bancroft. Arrangements had been made for a cabaret performance but owing to the inability of some of the entertainers to reach Worcester because of the storm a more informal program was presented.

Wednesday, Dec. 15, was designated as "Road Builders' Day," the proceedings being under the auspices of the Massachusetts Highway Association. Harold Parker, former Chairman of the Massachusetts Highway Commission, presided. The first speaker was William E. McClintock, Treasurer of the Winnisimmet Co., Chelsea, Mass., and formerly Chairman of the Massachusetts Highway Commission, who presented a paper entitled "The History of Highway Development in Massachusetts." Other papers of the forenoon were "What the United States Is Doing for the Good Roads Movement," by Logan Waller Page, Director of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; "The Merits of Refined Asphalt Roads," by Leroy M. Law, Chemist of the United States Asphalt Refining Co., and "The Merits of Natural Asphalt Roads," by Clifford Richardson, Consulting Engineer of the Barber Asphalt Paving Co. The paper by Mr. Richardson was read by title only, Mr. Richardson not being present.

At the close of the forenoon session there was a luncheon by the Massachusetts Highway Association in the ballroom of the hotel, the forenoon session being adjourned early to permit the necessary arrangements to be made. President Frederick H. Clark, Street Superintendent of Springfield, Mass., presided.

Mr. Parker again presided at the afternoon session, which was opened by the reading of a paper by George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y., on "City Pavements." In Mr. Tillson's absence, the paper was read by Herbert N. Davison, Secretary of the Worcester Chamber of Commerce.

W. A. McLean, Engineer of Highways of the Province of Ontario, Canada, who, as has been stated, was delayed in reaching Worcester, was the next speaker, his subject being "The Development of Improved Highways in Canada and What It Means to the Dominion."

Another speaker was J. R. Worcester, Consulting Engineer, Boston, Mass., whose paper dealt with "Concrete Bridges vs. Steel and Wood."

After adjournment, the usual afternoon concert was held in the Auditorium, and in the evening many of the delegates attended a moving picture exhibition at the Grand Theater adjoining the hotel, at which a 7,000-ft. film of scenes along the Lincoln Highway was shown.

Thursday, Dec. 16, was known as "Country and City Day," and the sessions were presided over by George M. Wright, Mayor of Worcester. In his introductory remarks, Mayor Wright referred briefly to the streets of the city of which he is the administrative head, stating that Worcester had done a great deal of permanent paving and that it was the aim of the administration to keep this up to a high standard.

Dr. Joseph Hyde Pratt, Secretary of the North Carolina Highway Commission, was the first speaker, his subject being "The Selection of Materials for Highway Construction."

Dr. Pratt was followed by Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City, who spoke on "Financing City Streets."

Joseph W. Gainer, Mayor of Providence, R. I., told about "Providence and Her Highway Development."

H. J. Kuelling, County Highway Commissioner of Milwaukee County, Wisconsin, followed with a paper on "Milwaukee County Concrete Roads."

Another speaker was Gustav Hanna, Commissioner of Street Cleaning of Cleveland, Ohio, who spoke on "The Importance of Street Cleaning in Good Roads."

Following adjournment for luncheon, Mayor James M. Curley of Boston, Mass., read a paper on "Boston's Experience with Various Types of Street Paving."

Dr. Ira N. Hollis, President of the Worcester Polytechnic Institute, followed with a paper on "The Necessity of Highly Trained Engineers in Highway Construction."

The next speaker was William H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pa., who discussed "The Organization of Highway Departments."

Miss Susan B. Willard, of Hingham, Mass., State Chairman of the Massachusetts D. A. R., read a paper on "Old Trail Roads."

Maj. W. W. Crosby, Consulting Engineer, Baltimore, Md., who was to have spoken at the Wednesday afternoon session but who was delayed in reaching Worcester, closed the session by reading his paper on "Selection of Types for Road Surfaces."

Thursday evening, a number of the cabaret performers having arrived in the meantime, an entertainment was given in the ballroom of the Hotel Bancroft.

The sessions on Friday, Dec. 17, which was designated as "Automobile Day," were presided over by Col. William D. Sohier, Chairman of the Massachusetts Highway Commission. In opening the conference, Col. Sohier told of the methods employed by Massachusetts authorities in controlling the operation of motor-driven vehicles and quoted a number of statistics to show the increase in the number of motor vehicles in the state. He also quoted figures to show the operation of the motor vehicle laws in other states.

The first speaker on the program at the morning session was George C. Diehl, of Buffalo, N. Y., Chairman of the Good Roads Board of the American Automobile Association. He took for his subject "The Automobile and Its Relation to Good Roads."

The next speaker was Edwin Duffey, State Commissioner of Highways of New York, who read a paper on "The Type of Pavements Now Being Laid on New York State Highways." He referred to the fact that within the last ten years the state of New York had spent $130,000,000 on good roads and had constructed approximately 6,000 miles of highways.

Henry Welles Durham, former Chief Engineer of Highways of the Borough of Manhattan, New York, N. Y., was the next speaker, his topic being "Improved Granite Pavements. He was followed by Lewis D. Speare, of Cambridge, Mass., former President of the American Automobile Association, who read a paper entitled "The Ideal Road for the Motorist."

The first speaker at the afternoon session was John H. Fahey, of Boston, Mass., President of the Chamber of Commerce of the United States, who chose for his topic "The Interest of the National Chamber of Commerce in the Good Roads Movement."

U. H. Dandurand, of Montreal, P. Q., Past President of the Dominion Automobile Association, spoke on "Canada as a Country for Motorists."

The next speaker was William R. Smith, President and General Manager of the Lane Construction Corporation, Meriden, Conn., who read a paper entitled "The Relation of Motor Trucks to Permanent Highways."

The session closed with remarks entitled "Hail and Farewell" by Charles P. Light, Field Secretary of the American Highway Association.

The exhibition of road machinery and materials was held in the Auditorium a short distance from the Hotel Bancroft and attracted considerable attention. Concerts were held in the Auditorium every afternoon and evening. The exhibitors were as follows:

American Car Sprinkler Co., Worcester, Mass.; American Tar Co., Boston, Mass.; Amies Road Co., Easton, Pa.; Association of American Portland Cement Manufacturers, Philadelphia, Pa.; John Baker, Jr., New York, N. Y.; Barrett Mfg. Co., New York, N. Y.; Harold L. Bond Co., Boston, Mass.; Philip Carey Co., Cincinnati, Ohio; Clinton Wire Cloth Co., Clinton, Mass.; Concrete Appliance Co., New York, N. Y.; Direct Sales Co., Inc., Boston, Mass.; "Engineering News," New York, N. Y.; "Engineering Record," New York, N. Y.; "Good Roads," New York, N. Y.; Good Roads Machinery Co., Kennett Square, Pa.; Hassam Paving Co., Worcester, Mass.; "Highway Contractor and Road Builder," Albany, N. Y.; Kinney Mfg. Co., Boston, Mass.; Mason Brush Works, Worcester, Mass.; R. B. McKim Co., Boston, Mass.; "Municipal Journal," New York, N. Y.; National Highways Association, Washington, D. C.; New England Metal Culvert Co., Palmer, Mass.; New England Truck Co., Fitchburg, Mass.; North East Metal Culvert Co., Nashua, N. H.; Robeson Process Co., New York, N. Y.; Ross Bros. Co., Worcester, Mass.; Standard Oil Co. of New York, New York, N. Y.; Chris D. Schramm & Son, Philadelphia, Pa.; Tiffin Wagon Co., Tiffin, O.; Trussed Concrete Steel Co., Detroit, Mich.; United States Asphalt Refining Co., New York, N. Y.; Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; Warner-Quinlan Co., New York, N. Y.; Wiard Plow Co., Batavia, N. Y.

Short Course in Highway Engineering at the University of Michigan

The second annual short course in highway engineering at the University of Michigan will be given at the university, Ann Arbor, Mich., February 21 to 25, inclusive.

Instruction will be given in road building by members of the faculty of the College of Engineering in cooperation with the Michigan State Highway Department. Additional instruction will be given by means of special lectures by men prominent in this particular line of work. The following program of lectures has been prepared for the course:

"The Economic Design of Highways with Reference to Traffic," Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; "Bituminous Surface Treatment for Water Bound Macadam and Gravel Roads," Chas. S. Reeve, Chief Chemist, Office of Public Roads, Washington, D. C.; "The Maintenance of Earth Roads," W. S. Gearhart, State Engineer of Kansas; "Specifications and Contracts," H. K. Vedder, Professor of Civil Engineering, Michigan Agricultural College; "The Duty of the County Road Commissioners," Wm. Kelly, Chairman, County Road Commission of Dickinson County, Michigan; "The Highway Engineer as a Public Servant," Ira O. Baker, Professor of Civil Engineering, University of Illinois; "Road Maintenance," Frank F. Rogers, State Highway Commissioner of Michigan.

The Public Schools of Alabama will observe Jan. 21 as Good Roads and Arbor Day. The Alabama Good Roads Association is taking an active interest in helping to make the day a success.

The County Road Commissioners of Wayne County, Mich., plans to construct 44 miles of concrete pavement and complete what is known locally as the outside drive around Detroit, Mich.

There Will Be an Election in Baldwin County, Ala., January 18 on the question of issuing bonds to the amount of $200,000 for general road work and $55,000 for work on the Mobile-Baldwin Road.

AMERICAN ROAD BUILDERS' ASSOCIATION

150 NASSAU STREET
NEW YORK, N. Y.

President
GEO. W. TILLSON, Brooklyn, N. Y.

First Vice President
A. W. DEAN, Boston, Mass.

Second Vice President
A. B. FLETCHER, Sacramento, Cal.

Third Vice President
(Office to be filled.)

Secretary
E. L. POWERS, New York, N. Y.

Treasurer
W. W. CROSBY, Baltimore, Md.

Through the courtesy of the publisher of "Good Roads," this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

Resolutions Passed by the Board of Directors

At a special meeting of the Board of Directors called for the purpose on December 16 at Worcester, Mass., during the meeting of the road congress in that city, the following resolutions were adopted:

"WHEREAS the American Road Builders' Association for several years has had under consideration the proposal to change the time of holding the annual convention, and being convinced that the best time for the holding of a highway convention or congress is immediately before rather than after the actual working season, has determined that its convention for 1916 shall be held in Pittsburgh, Pa., beginning February 28, 1916, and

"WHEREAS this Association is desirous of avoiding the holding of a series of national conventions during any one year, thus imposing upon highway officials and those who may wish to exhibit at such conventions the materials, supplies and machinery produced by them, the burden and inconvenience of attending such different meetings, and

"WHEREAS this Association, while convinced that an amalgamation of the different associations dealing with highway problems is inexpedient at the present time and that the holding of joint conventions under joint control is impracticable, believes that it would be entirely feasible for the two leading highway associations to hold their annual conventions at the same time and place; therefore be it

"RESOLVED that the Board of Directors of the American Road Builders' Association, in behalf of the said Association, hereby extends to the American Highway Association an invitation to hold its annual convention for the year 1916 at Pittsburgh at the same time as that of the American Road Builders' Association, with the assurance that this Association will do everything in its power to contribute to the success of both meetings, and be it further

"RESOLVED that, in case the American Highway Association favorably considers this invitation, the Executive Committee of the American Road Builders' Association, or such special committee as may be appointed by the President, be authorized to take up with the appropriate officers or committee of the American Highway Association the question of the preparation of a program for the two meetings, which shall avoid the duplication of subjects and will provide a program which will be of the greatest possible interest and profit to the members of both associations and all others interested in the question of highway improvement; and that said Committee be further authorized to make such provision as may be necessary for the meeting of the sessions under the control of the American Highway Association or the meetings of Committees of said association without expense to it, and be it also further

"RESOLVED that it is the hope of the Directors of the American Road Builders' Association that some plan such as has been outlined may be found satisfactory, not only for the meetings of 1916, but for subsequent meetings which may be held under alternate control."

A. R. B. A. Notes

John T. Gephart, Jr., who has been temporarily in charge of District No. 5, Pennsylvania State Highway Department, has been transferred to the Harrisburg office as Engineer of Construction.

Henry P. Morrison, who has been engaged in private practice at 21 Park Row, New York, N. Y., has been appointed Commissioner of Public Works of the Borough of Richmond, New York, N. Y.

W. R. Wolfinger, who has been Assistant Engineer in charge of District No. 9, Pennsylvania State Highway Department, has been transferred to District No. 5, with headquarters at Allentown.

B. F. Affleck, President of the Universal Portland Cement Co., Chicago, Ill., was elected President of the Association of American Portland Cement Manufacturers at the meeting of that organization held in New York City last month.

Henry Welles Durham, formerly Chief Engineer of Highways of the Borough of Manhattan, New York, N. Y., has been appointed County Engineer of Bergen County, New Jersey. He will continue his private practice at his present offices, 366 Fifth Ave., New York, N. Y.

J. R. Draney, Sales Manager of the United States Asphalt Refining Co., New York, N. Y., was appointed a committee of one to draft a constitution and by-laws for the proposed organization of asphalt producers, the tentative plans for which were made at a meeting held during the Worcester road congress last month.

Harold Parker, formerly Chairman of the Massachusetts Highway Commission, has associated with John A. Bensel and Col. E. W. Van C. Lucas in the practice of engineering, with offices at 111 Broadway, New York, N. Y. A notice of this, with an explanation of the working plan of the association, was printed in "Good Roads" for December 11.

LETTERS TO THE EDITOR

Hearing on the Luten Bridge Patents

Editor, "Good Roads":

In "Good Roads" for December 4, page 315, there is an item concerning the investigation the Senate Committee will make of the bridge patents issued to D. B. Luten, of Indianapolis, Ind., and the method of their issuance.

In this article you state: "The committee was appointed, the first of the hearings set for Nov. 8 and notices sent to the interested parties. Notwithstanding the fact that interests in Iowa and Kansas took part in bringing about the investigation, none of their representatives were present at the hearing. In addition, only one of the members of the committee—Senator James of Kentucky—was present. Mr. Luten, however, went to Washington for the hearing."

This statement gives an erroneous impression, in that no notice was received by the state highway departments or the departments of justice in Iowa or Kansas, nor was Senator Kenyon of Iowa, who is a member of the committee, notified that the first hearing would be held Nov. 8.

This hearing will begin about the first of January, and Iowa, Wisconsin, Nebraska, Oklahoma and Kansas will have representatives present.

W. S. GEARHART,
State Engineer of Kansas.

Manhattan, Kan.

"Specifications and Proposals"

Editor, "Good Roads":

Referring to your editorial in the issue of "Good Roads" of November 6, 1915, under the heading "Specifications and Proposals," the opinion is expressed that the engineer is frequently prevented from specifying the particular pavement that he thinks the most desirable for the traffic conditions in question, due to his wish to have an open specification. The idea is conveyed that this limitation is imposed by the fact that some form of patented pavement would be the most satisfactory, but that he hesitates to use it for fear of criticism.

The science of paving has been sufficiently developed so that with a fair traffic census, width of street and general local conditions known there could be little question as to the general type most fitting. I assume, of course, that the engineer is permitted to choose between wood block and cement concrete or sheet asphalt rather than macadam. Certainly there could be no question in this selection of the general type.

With the type determined it is simply a question of the particular form or ingredients or methods of laying of that special type. In the fourth paragraph you say, "If he calls for a material or method which is patented or which is controlled by some one individual or corporation." In my quite extensive experience throughout New England both as engineer and as material man, I have had the opportunity to observe every sort and kind of work laid in these states in all stages of construction and destruction and I cannot at present recall a case where the engineer was limited by conditions to such a degree that it was either necessary or desirable that he call for any brand of patented pavement.

I would be very much interested to hear of a case where a certain patented pavement was the only thing that would fill the bill in any ordinary street work.

Surely no one form of cement concrete or method of laying same has as yet proved its superiority over any other. In the field of block paving there are certainly no restrictions except those imposed by the proprietor of the blocks in his playing favorites with the contractors.

As to the use of bituminous products, I have personally inquired the opinion of no less than seventy road officials and contractors in Connecticut and Massachusetts, and in tabulating the experiences of these men can find no consensus of opinion that any one brand of bituminous binder or mixture has shown itself superior for any special method or condition.

In fact, such a diversity of results has been attained that it has become my firm conviction that the success or failure in the use of any of these standard products is entirely in the care and skill with which they are manipulated.

From my own observation I cannot imagine a condition where a specification could not be narrow enough to secure the proper *type* of work but at the same time be broad enough to admit of a variety of brands of ingredients which if laid with intelligent supervision would give satisfactory results.

R. B. HALL,
Paving Engineer.

209 Sherman Ave.,
New Haven, Conn.

REPORTS

UNIVERSITY OF TEXAS, BUREAU OF MUNICIPAL RESEARCH AND REFERENCE; First Biennial Report, September 1, 1913, to September 1, 1915; Bulletin No. 63 of the University of Texas, Municipal Research Series No. 12; published by the University, Austin, Tex. Paper; 6x9 ins., 20 pp. and covers.

This report contains a list of the staff and Advisory Board of the Bureau of Municipal Research and Reference of the University of Texas; a brief report covering the bureau's organization and purpose, its equipment and activities, and plans for future development; a map showing Texas cities which have been served by the bureau; a list of cities outside of Texas which have been served; a list of the members of the League of Texas Municipalities; a list of officers of the league, and a list of the publications of the Bureau of Municipal Research and Reference.

MONROE COUNTY, NEW YORK; "Good Roads of Monroe County, New York, 1915"; Report of County Superintendent of Highways J. Y. McClintock for 1915. Paper; 6x9 ins., 48 pp. and covers; illustrated; inset map, 2 inset tables.

Included in the contents of this report are detailed reports from each of the several towns in the county and a general report on the work by County Superintendent McClintock. The report of each town occupies two pages, the left-hand page carrying photographs of the supervisor and the town superintendent of highways and statistical data on the work done, and the right-hand page carrying a photograph of an improved road in the town and a road map of the town. The inset map is a road map of the entire county showing town macadam roads in red, town gravel roads in yellow and state and county roads in green. The inset tables show detailed figures on work done and expenditures made. Besides the illustrations previously mentioned, there are portraits of County Superintendent McClintock and District Supervisor Ira P. Cribb, a view in the city of Rochester, a map of the city of Rochester and a number of illustrations showing bridges and roads in various parts of the county. The report is printed on heavy white paper of good quality and the illustrations are excellent half tones and line cuts.

COMING MEETINGS

January 8—Alabama Association of Highway Engineers— Annual meeting. Montgomery, Ala. Secretary, J. B. Converse, Selma, Ala.

January 8—Louisiana Engineering Society—Annual meeting. New Orleans, La. Secretary, W. T. Hogg, State Museum Building, New Orleans, La.

January 14-15—Western Paving Brick Manufacturers' Association—Annual meeting. Kansas City, Mo. Secretary, G. W. Thurston, 416 Dwight Building, Kansas City, Mo.

January 17-19—Montana Institute of Municipal Engineers —Annual meeting, Billings, Mont. Secretary and Treasurer, C. C. Widener, Bozeman, Mont.

January 18-19—Virginia Road Builders' Association.—Fifth Annual Meeting, Murphy's Hotel, Richmond, Va. Secretary and Treasurer, S. L. von Gemmingen, Assistant Engineer, Virginia State Highway Commission, Lynchburg, Va.

January 21—American Society of Civil Engineers.—Special meeting for discussion of semi-final report of the Special Committee on Materials for Road Construction, Society House, New York, N. Y. Secretary, Charles Warren Hunt, Society House, 220 West 57th St., New York, N. Y.

January 26-28—Illinois Society of Engineers and Surveyors.—Annual meeting. University of Illinois, Urbana, Ill. Secretary, E. E. R. Tratman, Wheaton, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers. 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

PERSONAL NOTES

F. C. Allen, Commissioner of City Parks, Cleveland, O., has resigned to become City Manager of Newburgh, N. Y.

J. H. Smith has resigned as City Engineer of Tracy, Cal., to enter private practice with offices at San Francisco, Cal.

L. A. Brodie has been appointed County Road Engineer of Somerset County, Md., with headquarters at Princess Anne, Md.

L. B. Raab has been appointed City Engineer of Tracy, Cal., succeeding J. H. Smith, notice of whose resignation appears elsewhere in this column.

NEW PUBLICATIONS

ALABAMA STATE HIGHWAY DEPARTMENT; Bulletin No. 10, Road Laws of Alabama, November, 1915. Paper; 6x9 ins., 32 pp. and covers.

This bulletin, recently published by the State Highway Engineer of Alabama, in accordance with a resolution of the State Highway Commission, contains all of the road laws passed by the 1915 session of the Legislature. The bulletin contains, besides the laws, a list of roads in each county of the state designated as state trunk roads, in accordance with a law designated as "An act to designate certain public roads of the State of Alabama as state trunk roads and to provide the manner in which such roads shall be located, improved and maintained."

METHODS FOR THE EXAMINATION OF BITUMINOUS ROAD MATERIALS, by Prevost Hubbard, Chemical Engineer, and Charles S. Reeve, Chemist; Bulletin No. 314, United States Department of Agriculture; Professional Paper; Contribution from Office of Public Roads and Rural Engineering; December 10, 1915.—Paper; 6x9 ins., 48 pp.; illustrated.

Included in this bulletin are illustrated descriptions of the principal tests of bituminous material, including the following: Specific gravity determination; float test; penetration test; melting point determination; determination of flash and burning points; volatilization test; distillation test; dimethyl sulphate test; determination of bitumen soluble in carbon disulphide; determination of bitumen insoluble in paraffin naphtha; determination of bitumen insoluble in carbon tetrachloride; determination of fixed carbon; determination of paraffin scale; the extraction of bituminous aggregates; grading the mineral aggregate; determination of voids in the mineral aggregate; methods of examining bituminous emulsions. Besides the descriptions of the tests themselves, there are in most cases discussions of the uses of the various tests. An appendix includes a list of the necessary laboratory equipment for the routine testing and inspection of bituminous materials, conversion tables and report forms.

NEWS NOTES

The Last of New Jersey's Toll Roads passed out of existence recently when the Board of Freeholders of Bergen County took over the Bergen Turnpike. The Public Service Corporation of New Jersey, which operates a trolley line on the turnpike, agreed to take care of the bonded indebtedness of the road, amounting to $1,000,000. The road was built by private subscription in 1802. There were four toll gates on it.

Fifty Convicts from the Southern Illinois Penitentiary are building a highway from Ava, Jackson County, to the Mississippi River. No guards were sent with the convicts and the officer in charge is unarmed. Each prisoner is allowed one day off his sentence for every two days worked on the roads. Citizens of Ava and vicinity contributed $2,500 toward the maintenance of the convict camp.

Street Cleaning in the City of Cleveland, Ohio, during 1914, cost slightly over $500,000, according to the annual report of Gus H. Hanna, Superintendent of Street Cleaning of that city. Of the total, $292,758.99 was expended for labor and operation, $7.659.25 was expended for supplies, $5,965.20 was expended for maintenance and $194,142.42 was expended for miscellaneous purposes. Included in the last mentioned amount is an item of $176,948.19 for team hire. During the year 297,630.65 "squares" (a square contains 10,000 sq. ft) were flushed, at an average cost of 15.338 cts. per square; the work of pick-up gangs covered 85,640.75 squares, at an average cost of 89.118 cts. per square, and the work of the white wings covered 259,645.34 squares, at an average cost of 42.786 cts. per square. The unit cost in each of the three foregoing items includes overhead charges. The "grand" average cost of street cleaning for the year, according to Superintendent Hanna, was 36.224 cts. per square. During the year salable materials to the value of $21,592.43 were collected.

EQUIPMENT — TRADE — MATERIALS

The Yuba Champion Ball Tread Tractor

With the development of the gas engine has come a corresponding development in the gasoline tractor, to the gradual elimination of the horse as motive power in various kinds of work. What the automobile is doing today in solving the problem of short distance transportation the gasoline tractor is doing in short distance hauling. The field of usefulness of the tractor, however, is by no means confined to hauling. It is adaptable to so many and varied applications by the contractor and road builder that the uses to which it is put at present may be regarded as being practically only preliminary.

The Yuba Champion Ball Tread Tractor, manufactured by the Good Roads Machinery Co., Incorporated, of Kennett Square, Pa., is distinctive inasmuch as it embodies peculiar features of economical operation and flexibility of use. The tractor frames are of heavy channel steel, truss-braced for vertical and horizontal strains, and the machine, which has an over all length of 14 ft. 7 ins., provides an actual 12-horse pull and develops 20 HP. as a stationary plant, the motor horse power being 35-40. The motor is water cooled, the water circulating through jackets on each pair of cylinders and being itself cooled by a flat tube radiator with a total radiating surface of approximately 18,000 sq. ins. The tractor, fully equipped, has a total weight of 7,600 lbs., with a weight on the tiller wheel of 1,600 lbs. and a weight on treads of 6,000 lbs. It is capable of a speed of 3.25 miles per hour in high gear and of 2 miles per hour in low.

The specifications given above are for the Model 12 tractor. Another model, No. 18, is somewhat larger, having an over all length of 15 ft. 1 in. and being capable of developing a speed of 3.5 miles per hour on high and 2.25 miles on low gear. The total weight of this model is 8,900 lbs., with a weight on the tiller wheel of 1,500 lbs.

In addition to its use as a tractor, the machine may be utilized for driving pumping machinery and for other similar work, the standard equipment of both models including an 18-in. pulley with a 6½-in. face.

The tractor is so arranged that it may be equipped with electric lighting system and may be also provided with a canopy top.

Tiffin Motor-Driven Street Flusher

The increased area of paved city streets and the more general recognition of the necessity of the thorough cleansing of pavements has naturally stimulated the design of street cleaning equipment while the substitution of the gasoline motor for the horse to furnish motive power has made possible the building of machines of this kind of greater capacity and efficiency than was possible under former conditions.

One of the street cleaning machines which have been put on the market recently is the motor-driven street flusher shown in the accompanying illustration.

The flusher, which is similar, in its general features, to the Tiffin Auto Flusher described in these columns in the issue of May 1, 1915, was shown at the exhibition of street cleaning equipment held in New York City in October of last year. During the exhibition, it was also demonstrated daily on West End Ave., and attracted much attention.

Briefly described, the flusher consists of a 6-ton motor truck chassis, equipped with a 6-cylinder Continental motor. Mounted on the chassis is a 1,500-gal. water tank and the distributing mechanism which includes an additional gasoline

YUBA CHAMPION BALL TREAD TRACTOR MADE BY THE GOOD ROADS MACHINERY CO., INC.

motor and a centrifugal pump for discharging the water under pressure. The pump motor is a 4-cylinder, 20-HP. Continental motor and is located at the rear of the tank. The 2½-in. centrifugal pump is capable of delivering 250 gals. of water per minute at a pressure of 70 lbs. per sq. in. There are four discharge nozzles, one on each side about half way between the front and rear wheels, and one at each side at the front of the machine. The nozzles can be operated singly or in any desired combination, and are so arranged that by driving down the center of the street the entire wirth of the pavement can be flushed at one operation.

Sprinkling nozzles which are interchangeable with the forward flushing nozzles are also provided, so that the machine can be used for both power flushing and sprinkling and gravity sprinkling.

The pump motor, as well as the motor for driving the truck, is controlled from the operator's seat, the two motors being entirely separate. Any desired water pressure may be maintained regardless of the speed of the vehicle and is one of the chief advantages claimed for the machine. Another is that the two motor arrangement is more economical as the extra horse power required for operating the pump need not be provided for in the vehicle motor and the flusher motor is in operation only when flushing is being done.

The entire separation of the propelling and water pressure systems also makes it possible to remove the tank and use the chassis for other purposes during that season of the year when street flushing is impractical. Where hydrants are not available for filling the tank, a special attachment can be provided for drawing the water supply from rivers, creeks or other sources.

The machine is known as the Model 80 Motor-Driven Power Flusher, and is manufactured by the Tiffin Wagon Co., of Tiffin, Ohio.

Besides the 1,500-gal. machine described, the flusher is also made in 900, 1,000, 1,200 and 1,400 gal. capacities. The flusher previously described in these columns was one of the 900-gal. machines.

TRADE NOTES

An illustrated booklet of eight pages and cover has been issued by the New England Truck Co., Fitchburg, Mass., describing the Netco road oiler and combination service truck. The illustrations are all half-tone reproductions of the truck and some of its parts.

The Barber Asphalt Paving Co., Philadelphia, Pa., has issued a 20-page booklet entitled "The Asphalt Primer and Colloidal Catechism," which contains in question and answer form, an explanation of the principles of colloidal chemistry as applied to the paving industry. The booklet, which is bound in buff paper, is a replica of one of Benjamin Franklin's publications and is illustrated with wood cuts of ancient and modern highway building.

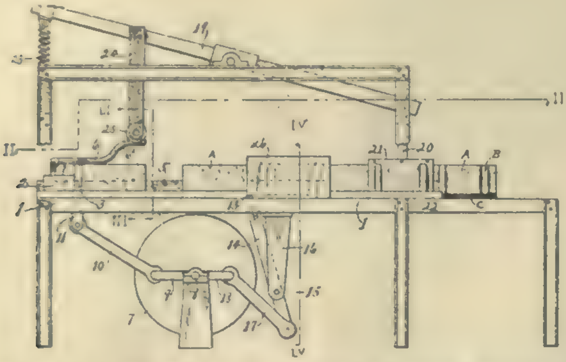
The Wooster Shale Brick Co., Wooster, Ohio, has been absorbed by the Deckman-Duty Brick Co., of Cleveland, Ohio. There will be a reorganization, the Deckman-Duty Brick Co. increasing its capital stock to $1,000,000 and changing its name to the Medal Paving Brick Co., the word "Medal" having been the brand name of the Deckman-Duty paving brick. The company will continue to manufacture paving brick, both repressed and wire-cut lug, at the four plants located at Wooster, Cleveland, Malvern and Carrolton, Ohio, which will provide an annual output of approximately 50,000,000 brick. The officers of the Deckman-Duty Brick Co., Spencer M. Duty, Charles J. Deckman and Herbert C. Moatz, together with W. R. Barnhart, Jr., President of the Wooster Shale Brick Co., will be officers of the new corporation.

The Permanent Road and Bridge Association of St. Louis County, Mo., has filed with the County Commissioners a petition for an election on a bond issue of $3,000,000. Details of this project were published in the Nov. 20 issue of "Good Roads."

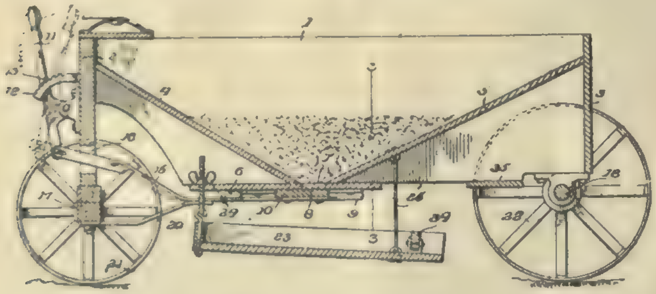
MODEL 80 MOTOR-DRIVEN POWER FLUSHER MADE BY THE TIFFIN WAGON CO.

RECENT PATENTS

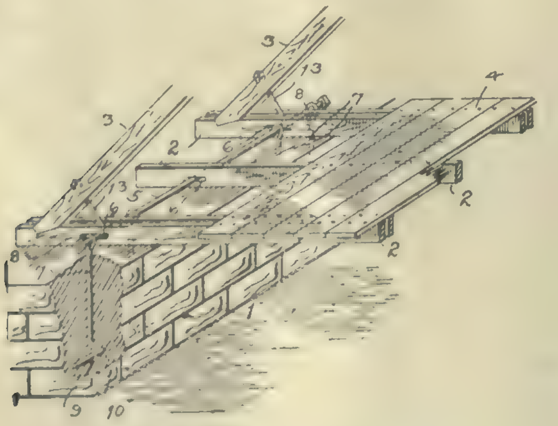
The following list contains the numbers of the principal patents relating to roads and pavements and to machinery used in their construction or maintenance which have recently been issued, together with the names and addresses of the patentees, dates of filing, serial numbers, etc. In some cases the principal drawing has also been reproduced. Printed copies of patents listed may be obtained for 5 cts. each by application to the Commissioner of Patents, Patent Office, Washington, D. C.:



1,161,956. MACHINE FOR MANUFACTURING RIBBED AND HILLSIDE PAVING BLOCKS. Joseph B. Nicholson, Steubenville, Ohio. Filed Jan. 19, 1915. Serial No. 3,054. (Cl. 25-1.)



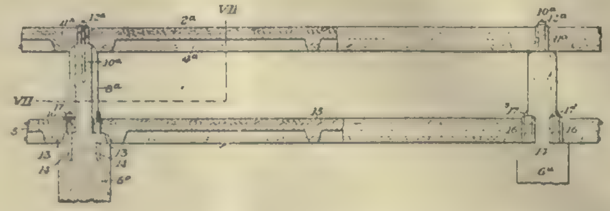
1,162.029. MACHINE FOR SPREADING ROAD SURFACING MATERIAL. Garrett Burns, Canandaigua, N. Y. Filed Jan. 7, 1915. Serial No. 1,013. (Cl. 111-34.)



1,162,038. BRIDGE ANCHOR. Noah Cool, near Arcanum, Ohio. Filed June 23, 1913. Serial No. 775,174. (Cl. 14-14.)

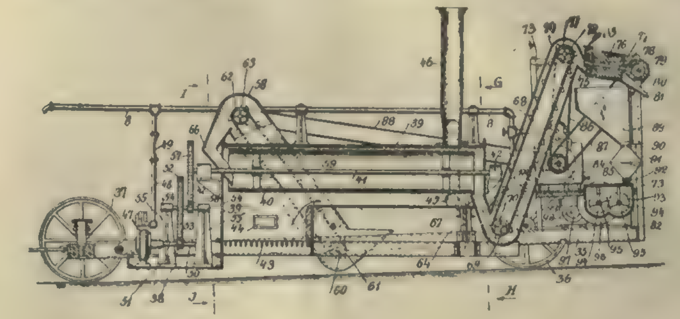
1,163,593. MANUFACTURE OF ASPHALT CEMENT FROM NATURAL ASPHALTS. Charles N. Forrest, Rahway, N. J., assignor to The Barber Asphalt Paving Co., Philadelphia, Pa., a corporation of West Virginia. Filed Aug. 20, 1912. Serial No. 715,973. Renewed Feb. 26, 1915. Serial No. 10,867. (Cl. 106-31.)

1,163,641. ADJUSTABLE FALSE WORK. Robert Augustus Cummings, Pittsburgh, Pa. Filed Aug. 3, 1914. Serial No. 854,-679. (Cl. 14-2.)

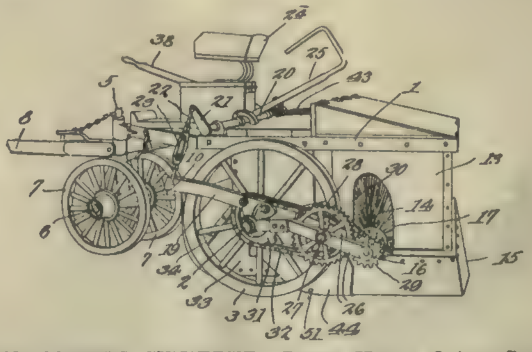


1,162,282. REINFORCED CONCRETE ROAD GUARD. Charles F. Buente, Pittsburgh, Pa., assignor to Concrete Products Co. of Pittsburgh, Pittsburgh, Pa., a corporation of Pennsylvania. Filed Apr. 18, 1914. Serial No. 832,761. (Cl. 256-19.)

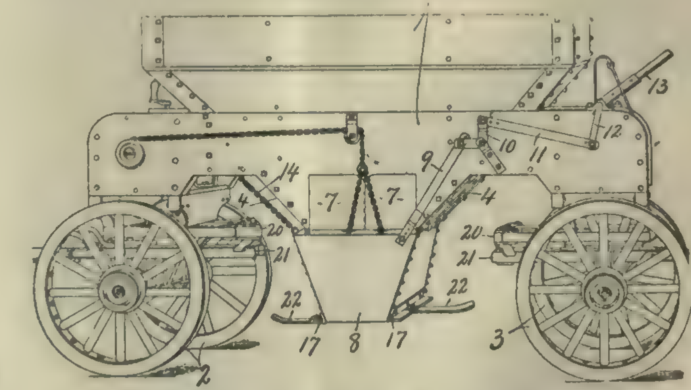
1,163,640. CULVERT FORM. James Marion Cooper, McLeansboro, Ill. Filed May 15, 1912. Serial No. 697,477. (Cl. 25-128.)



1,163,825. MACHINE FOR PREPARING ROAD WEARING SURFACES. Livingston Stagg Kasson, New York, N. Y., assignor to the A. L. Barber Asphalt Co., New York, N. Y., a corporation of the District of Columbia. Filed Dec. 17, 1908. Serial No. 467,963. (Cl. 94-6.)



1,163,948. STREET SWEEPER. James Henry Osten, Springfield, Ill., assignor to The Baker Mfg. Co., Springfield, Ill. Filed Mar. 23, 1915. Serial No. 16,355. (Cl. 15-17.)



1,163,949. DUMP WAGON. George W. Otterson, Seattle, Wash. Filed Dec. 21, 1914. Serial No. 878,203. (Cl. 21-20.)

1,164,281. DUMP WAGON. John W. Haywood, Newark, N. Y., assignor to John Haywood, Newark, N. Y. Filed Jan. 25, 1911. Serial No. 604,605. (Cl. 21-20.)

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. XLIX
New Series, Vol. XI.

NEW YORK, JANUARY 8, 1916

Number 2

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Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Pennsylvania Specifications for Road Work to Be Revised

The assistant engineers of the Pennsylvania State Highway Department, together with the office engineers of the department, have been formed into committees by Chief Engineer W. D. Uhler for the purpose of discussing and analyzing various phases of the specifications now in use by the department.

Chief Engineer Uhler is not satisfied with the present specifications for highway construction and has spent considerable time in revision and amendment. The committees of assistant engineers will hold day and evening sessions until a thorough plan of revision has been formulated.

Washington State Highway Board Plans Work Next Year

The State Highway Board of Washington met recently and approved plans and specifications for road work to be done during 1916 at a cost of approximately $125,000. The board authorized a call for bids on the work, which includes the following sections of the Inland Empire Highway:

Pullman, south for 8.75 miles, $29,460; Kiona to Richmond, Benton County, 11.6 miles, $25,576; Touchet to Wallula, Walla Walla County, 9.5 miles, $33,611; Rosalia to Oakesdale, 9.5 miles, $27,960. This is all construction work.

In addition to the above, the board decided to authorize the preparation of plans and specifications for construction work on State Road No. 10 in Chelan County, at a cost of about $10,000.

Good Roads Institute at the University of North Carolina

A good roads institute will be held at the University of North Carolina, February 7 to 12, inclusive. In the issue of December 18, 1915, it was stated that it would be held during February, the date not having been definitely fixed at that time.

While details as to the subjects to be taken up are not yet available, it is stated that one topic which will be given especial attention is that of the maintenance of earth, sand-clay, gravel and macadam roads. The work on this subject will include practical demonstrations of the road drag.

Columbia University-Automobile Club Lectures on Highway Work

The course of illustrated lectures on highway construction and maintenance, which is being given under the joint auspices of the Department of Highway Engineering, Columbia University, and the Automobile Club of America, in New York City, and which was mentioned in the December 11 issue of "Good Roads," will be continued during January.

On January 4, Walter H. Fulweiler, Chief Chemist, United Gas Improvement Co., Philadelphia, Pa., spoke on the "Chemistry, Manufacture, Transportation and Control Testing of Refined Water Gas Tars," in Room 402, Engineering Building, Columbia University, and on January 6, Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York City, lectured in the Assembly Hall of the Automobile Club, his subject being "Regulations and Restrictions which Influence the Planning of Streets and Street Systems."

The lectures begin at 8:30 p. m. and are open to the public. The program for the remainder of the month is as follows:

January 13—"Utilization of Bituminous Mortars in the Construction of Bituminous and Block Pavements," Sumner R. Church, Manager, Research Department, Barrett Manufacturing Company, New York City. Room 402, Engineering Building, Columbia University.

January 17—"Prevention and Repair of Street Openings and the Location and Design of Pipe Systems," George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York City. Assembly Hall, Automobile Club of America, 247 West 54th Street.

January 24—"The Economics of Guarantees of Pavements on State and Municipal Highways," George C. Warren, President, Warren Brothers Company, Boston, Mass. Assembly Hall, Automobile Club.

January 26—"Essential Physical Properties of Sand, Gravel, Slag and Broken Stone for Use in Bituminous Pavements," Francis P. Smith, Chemical and Consulting Paving Engineer, New York City. Room 402, Engineering Building.

January 31—"Limitations of Results of Tests of Bituminous Materials," C. N. Forrest, Chief Chemist, Barber Asphalt Paving Company, Maurer, N. J. Room 402, Engineering Building.

Motor Truck Traffic[*]

By Wm. Rice Smith[†]

If commercial vehicles are not going to block our highways, we must make our pavements wide enough so they can have plenty of searoom to tack about, and at the same time increase the strength of foundations so the motor truck won't sink.

A few figures in regard to the registration of commercial vehicles in Massachusetts may be interesting. There were 6,000 commercial vehicle licenses taken out in 1913, 8,000 in 1914, and 12,000 in 1915—there being twice as many trucks in use in 1915 as in 1913.

In 1913 there were 10 pleasure cars to 1 commercial vehicle; in 1914. 9 to 1; in 1915, 8 to 1. Business may overtake pleasure in a few years.

Since 1909 the Massachusetts Highway Commission has at stated times taken a traffic census, or, in other words, counted the number and made notes of the kinds of vehicles passing a given point on a certain highway in a specified length of time each year. These figures show clearly how fast motor trucks are increasing in numbers on our highways.

Following is the detail of the census on commercial vehicles, taken on a few highways with which many of you are familiar:

On the road from Boston to Quincy, the motor trucks in 1912 counted 35, against 146 in 1915.

Between Fall River and New Bedford, 29 to 230.

Between your city and Springfield, 5 to 20.

Between Worcester and Boston, by way of Shrewsbury 15 to 45.

On the North Shore Drive, out of Boston, 46 to 208.

A general summary of the census on highways out of Boston in 1912 records a count of 546, against a count in 1915 of 1,559.

The most destructive force that pavements are obliged to meet by the use of motor trucks is the vibration caused by impact. A reasonable formula of impact may be:

Impact.—Weight times speed per mile an hour, squared. If this formula is correct, the impact given a pavement by a car running 12 miles an hour is four times as great as that given by a car running 6 miles. This formula may be reasonable for solid tires, but I question if it should be used where pneumatic tires are on the wheels. Laws can be expected in the near future that will regulate the speed of commercial vehicles by the loads they are intended to carry. With horse-drawn vehicles, speed never has been a factor, because the load has largely regulated the motion.

The City of Springfield recently received protest on the part of citizens living on a residential street that motor busses running through a street were a nuisance because of the vibration of pavement transmitted to the walls of their houses. Heavy cars running at excessive speed were the cause of the trouble, and complaint would not have been made if speed had been in reason. In rural districts the matter of vibration is not important as regards the abutter, but in relation to the life of the pavement is most important, for in a general way the country roads are not constructed to stand the heavy traffic.

We recently had occasion to jump a chauffeur on one of our trucks because his hauling costs were high. He came back with a remark that if he could remove the governor, it would help a good deal. An attachment on the make of the truck we are using makes it absolutely impossible to run over 12 miles an hour, and on down grades we insist that the clutch shall not be thrown out, and coasting is entirely against orders. My observation leads me to think a good many trucks are made without a governor, or speeded to the limit. If you could apply a governor to the chauffeur's mind instead of to the car, it would be a good idea.

The element of danger alone should hold down speed of trucks. You pass a man running his car 40 miles an hour and do not notice it. You have more respect for the truck coming your way at 10 miles.

A skidding truck does the maximum amount of damage.

Spring tires or pneumatic tires on trucks are vastly different propositions for pavements than even solid tires of rubber, and there should be laws restricting the use of motor trucks carrying heavy loads where the bulk of the load comes on rear wheels, steel shod.

Damage to pavements constructed with a view to motor truck use is not excessive if rubber tires are used on vehicles, proportioned in reason to the load carried. In a general way, permanent pavements are swept by pleasure cars and pounded by trucks.

The effect of self-propelled traffic is only more damaging than the horse-drawn traffic where the road surface is unsuitable for the purpose of carrying such vehicles.

Some one should be found to pay for the added cost of building pavements for motor truck use. The dear people have quite some tax now, which will be increased by the time we are prepared to fight the world. The truck owner is inclined to pass the problem on to the man running a pleasure car.

Some sections of England are taxing their trucks on car mile basis, this tax in one case being ¾ of a cent per car a mile. It is difficult to see why commercial motor car lines are not public utilities, and subject to franchise tax same as street railways.

A mileage tax on trucks may be in reason. When idle, a truck is innocent, but when at large, it is difficult to tell how guilty.

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[*] From a paper entitled "Relation of Motor Trucks to Permanent Highways," presented at the recent road congress at Worcester, Mass.

[†] President, Lane Construction Corporation, Meriden, Conn.

Short Course in Highway Engineering at University of Illinois

The program for the short course in highway engineering at the University of Illinois, Urbana, Ill., brief mention of which was made in the December 18 issue of "Good Roads," embraces lectures and discussions and practical demonstrations of road and bridge construction and maintenance.

The course will be under the direction of the Civil Engineering Department, College of Engineering of the university and will cover the two weeks from January 10 to 21. The demonstrations will embrace surveys, drawings, records and methods of construction and maintenance of earth, oiled earth, gravel, macadam, and bituminous roads and concrete and brick pavements, surveys for bridges and economics of bridge design, bridge failures and their causes, inspection of old and new steel bridges and new concrete bridges, estimating the cost of a concrete culvert and of a steel bridge.

The program of lectures and discussions is as follows:

January 10.—"U. S. Reclamation Service and Highways," Dr. F. H. Newell, Head of Civil Engineering Department, former Director of U. S. Reclamation Service.

January 11.—"Maintenance of Earth Roads," W. S. Gearhart, State Engineer of Kansas; "The Need of Balance in a System of Roads," H. E. Bilger, Illinois Highway Department; "Oiling Clay, Gumbo and Sand Roads," W. S. Gearhart; "Effect of Roads Upon Rural Life," Dr. R. E. Hieronymus, Community Advisor, University of Illinois.

January 12.—"Effect of Illinois State Aid Road Law," W. W. Marr, Chief Engineer, Illinois State Highway Department; "Road Management," Dr. L. I. Hewes, Chief of Economics and Maintenance, U. S. Office of Public Roads; "Properties of Oils, Tars and Asphalts," S. W. Parr, Professor of Applied Chemistry; "Construction of Macadam Roads," Dr. Hewes.

January 13.—"Earth Handling Machinery," C. R. Thomas; "Oiled Earth Roads," B. H. Piepmeier, Illinois State Highway Department; general discussion: (a) "Success of Road Day," (b) "Cooperation of Chambers of Commerce, Automobile Clubs, etc., in Road Building," (c) "Stimulating Interest in Better Roads," "Asphaltic Highway Construction," W. P. Blackwood, Barber Asphalt Paving Co.

January 14.—"Road Making Machinery: Its Use and Maintenance," T. R. Agg, Professor of Highway Engineering, Iowa State College; general discussion: "Safety First in Highway Structures: Railway and Grade Crossings, Road Signs, Guard Rails, etc.," "Choice of Type of Road and Principles of Design," Prof. Agg; "Use of Petroleum Products in Road Work," James A. Cannon, National Refining Co.

January 15.—"Economics of Bridge Floors," Clifford Older, Bridge Engineer, Illinois State Highway Department; "Shall the County Buy Road Building Machinery?" G. N. Lamb, Superintendent of Highways, Kane County, Ill.; laboratory demonstrations by B. L. Bowling, C. C. Wiley and N. B. Garver of the university faculty.

January 17.—"Relation of the County Superintendent of Highways to the Township Road Commissioners," L. B. Neighbor, Superintendent of Highways, Lee County, Ill.; laboratory demonstrations by members of the university faculty; "Highways and Waterways," Dr. Newell.

January 18.—"Wisconsin Highway Standards," A. R. Hirst, State Highway Engineer, Wisconsin; "Creosoted Timber in Highway Construction," A. L. Keuhn, American Creosoting Co.; "Road and Bridge Construction in Wisconsin," A. R. Hirst; "Use of Coal Tar in Highways," Philip P. Sharples, Manager, General Tarvia Department, Barrett Manufacturing Co.

January 19.—"Standard Highway Construction in Iowa," T. H. MacDonald, State Highway Engineer, Iowa; general discussion: "Safety First in Highway Traffic: Speed Regulations, Hedges, Superelevation on curves, Color of paint on bridges, Vehicle lights, etc.;" "Road and Bridge Construction in Iowa," T. H. MacDonald; "Concrete Road Construction," C. M. Powell, Universal Portland Cement Co.

January 20.—"Importance of Minor Details in Concrete Work," C. M. Powell; "Some Things Learned in Building Brick Pavements," J. W. Stipes, Contractor, Champaign, Ill.; laboratory demonstrations; "The Manufacture and Properties of Paving Brick," A. V. Bleininger, Professor of Ceramic Engineering.

January 21.—"Machinery for Building Stone Roads," G. A. Quinlan, Superintendent of Highways, Cook County, Ill.; "Work of the Illinois Highway Commission," A. D. Gash, President, Illinois State Highway Commission; "The Farmer's Viewpoint of Road Improvement," James P. Wilson, Illinois State Highway Commission. The evening session will be held at the Hotel Beardsley, Champaign, Ill., where a banquet will be held. Following this will be short addresses on "Financing Road Improvements," S. E. Bradt, Secretary, Illinois State Highway Department; "Financing Road Improvements in Williamson County," P. B. Wilson, Superintendent of Highways, Williamson County, Ill:; "Financing Road Improvements in Cook County," G. A. Quinlan; "Roads and Rural Credit," B. F. Harris, President, First National Bank, Champaign, Ill.

Wheel Tax Recommended by the North Carolina State Highway Commission

In a statement recently issued by Dr. Joseph Hyde Pratt, Secretary of the North Carolina State Highway Commission, the efficacy of a wheel tax to provide funds for road maintenance is argued.

The statement calls attention to the fact that the maintenance of the public roads is a serious question not only in North Carolina but in other states. In West Virginia, it is stated, lumber wagons have been doing a great deal of damage to the roads and the county engineers are now enforcing an act recently passed at the extraordinary session of the last Legislature. This law provides that persons, firms, etc., making continuous use of any piece of county road, causing by such use more than the usual wear, may be compelled to put thereon a section-man or section-men and keep or assist in keeping the road in such repair as the court may order. It further provides that any person disobeying or refusing such orders may be adjudged guilty of a misdemeanor, upon conviction of which he may be fined not to exceed $50, or imprisoned, or both.

According to Dr. Pratt, this action of the West Virginia Legislature is a move in the right direction, but he is still of the opinion that the wheel tax method of furnishing a maintenance fund is far more practical and effective. He points out that all the people of the counties are taxed for the construction of the roads but that it is the users of the roads who should pay the greater part of the cost of maintenance. This can be accomplished by the wheel tax, all the revenue therefrom being used for road maintenance. He recommends a wheel tax graduated according to the amount of damage done to the roads, the tax increasing with the weight of the vehicle, the width of the tire remaining constant, and decreasing with the increase in the width of the tire, the load remaining constant.

Motor Vehicle Licenses in New York and Pennsylvania

According to a report issued by the Automobile Bureau of the office of the Secretary of State of New York, the receipts from licenses for motor vehicles during eleven months of 1915, ending December 31, amounted to $1,905,153, as compared with $1,618,060.36 for the 12 months of 1914. The automobile year in New York State ends with January 31. For the period noted 233,325 automobiles were registered by owners and dealers.

The Automobile Division of the Pennsylvania Highway Department reports receipts of $1,665,276.50 for motor vehicle licenses during 1915. Up to the close of business on January 3, $864,304 had been received for 1916 registrations.

Highway Engineering Course at Texas A. and M. College

The annual short course in highway engineering will be given at the Agricultural and Mechanical College of Texas from January 12 to 26. In previous years the length of the course has been four weeks and it is believed that reducing the time to two weeks will increase the attendance.

The course is not rigidly prearranged, but a rough outline of the work is made which may be varied more or less to meet the needs of the majority of the men who come to take the course.

Railroad Aiding Road Construction

On the theory that good roads will increase the amount of freight to be carried by it and stimulate the good will of citizens, the Nasville, Chattanooga & St. Louis Railway is lending active support to the good roads movement in Tennessee.

The railway has recently completed a two-mile road from Tullahoma, Tenn., to its demonstration farm. The road is 20 ft. wide and is built of chert. The railway has also furnished a special train to carry 600 men to work on the White County, Tenn., section of the Memphis-to-Bristol Highway and supplied all of the tools used. With this assistance, 10 miles were cleared in one day.

COMING MEETINGS

January 14-15—Western Paving Brick Manufacturers' Association—Annual meeting. Kansas City, Mo. Secretary, G. W. Thurston, 416 Dwight Building, Kansas City, Mo.

January 17-19—Montana Institute of Municipal Engineers—Annual meeting, Billings, Mont. Secretary and Treasurer, C. C. Widener, Bozeman, Mont.

January 18-19—Virginia Road Builders' Association.—Fifth Annual Meeting, Murphy's Hotel, Richmond, Va. Secretary and Treasurer, S. L. von Gemmingen, Assistant Engineer, Virginia State Highway Commission, Lynchburg, Va.

January 18-20—Michigan Engineering Society.—Thirty-seventh annual meeting, Grand Rapids, Mich. Secretary, S. J. Hoexter, Ann Arbor, Mich.

January 19-22—Illinois Association of County Superintendents of Highways.—Annual convention, University of Illinois, Urbana, Ill. Secretary-Treasurer, W. E. Emery, Peoria, Ill.

January 21—American Society of Civil Engineers.—Special meeting for discussion of semi-final report of the Special Committee on Materials for Road Construction, Society House, New York, N. Y. Secretary, Charles Warren Hunt, Society House, 220 West 57th St., New York, N. Y.

January 23—American Society of Engineering Contractors.—Annual meeting, New York, N. Y. Secretary, J. R. Wemlinger, 45 Whitehall Street, New York, N. Y.

January 26-28—Illinois Society of Engineers and Surveyors.—Annual meeting. University of Illinois, Urbana, Ill. Secretary, E. E. R. Tratman, Wheaton, Ill.

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

Michigan Engineering Society

The 37th annual convention of the Michigan Engineering Society will be held at Grand Rapids, Mich., on January 18, 19 and 20, as noted above.

A program has been prepared embracing papers on various topics relating to state, county and city engineering work, each to be followed by a discussion.

Illinois County Superintendents of Highways

As noted above, the annual meeting of the Illinois Association of County Superintendents of Highways will be held at Urbana, Ill., January 19-22.

The meeting will be held during the short course in highway engineering given under the auspices of the University of Illinois, January 10-21.

According to the program, as at present arranged, the opening session on Wednesday, Jan. 19, will include the presentation of reports of officers and committees and the consideration of the topic "Legislation." The special business on Thursday, Jan. 20, will include reports on "Machinery and Supplies," and on "Records, Reports and Accounts." Friday, Jan. 21, will be devoted to the election of officers, unfinished business and new business. Other meetings may be called for Saturday, Jan. 22.

The fifth annual meeting of the Lincoln Highway Association of Colorado will be held at the Albany Hotel, Denver, Colo., at 8 p. m., on Wednesday, Jan. 19. The order of business will include the reception of reports on the year's work, the election of officers and the consideration of plans for future work.

MEETINGS

Alabama Association of Highway Engineers

The annual meeting of the Alabama Association of Highway Engineers is in session today in the offices of the State Highway Department, Montgomery, Ala. The attendance, in addition to highway engineers, includes county commissioners, probate judges and other officials.

The program, which will conclude with an automobile tour of the city this afternoon and a banquet tonight, consists of papers and discussions on the following topics:

"Should Civil Engineers Be Licensed to Practice Their Profession?" "Professional Etiquette"; "Should Counties Pay Their Highway Engineers a Specified Salary, or Should They Pay for Engineering Service on a Percentage Basis of the Cost of the Work Done?" "Relation of a County Engineer to County Board of Revenue or Commissioners."

NEWS OF THE TRADE

The General Electric Co., Schenectady, N. Y., has issued Bulletin No. 43253, which deals with luminous arc lamps for street lighting. The bulletin contains 16 pages and is profusely illustrated with half-tones showing various types of lamps and street scenes in various cities where lamps of this character are in use.

The Martin Rocking Fifth Wheel Co., Springfield, Mass., has taken over the patent rights and business of C. H. Martin, Springfield. The officers of the new corporation are C. H. Martin, President; Adolf A. Geisel, Treasurer, and H. G. Farr, Secretary. Mr. Geisel will have the general management of the business.

The Bell Locomotive Works, Inc., has been reorganized and has moved its offices from Brooklyn, N. Y., to 30 Church Street, New York City. The new officers are as follows: President, Prescott Warren; Vice-President and Consulting Engineer, Carl Stanley; Secretary and Treasurer, Edward Hallett; Chairman of the Board of Directors and General Manager, Harvey W. Bell.

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Road Builders' Week at the University of Kentucky

Road Builders' Week, during which a short course in highway work will be given, will be held at the State University of Kentucky, Lexington, Ky., February 7 to 12. The course will be under the direction of the Highway Engineering Department, College of Civil Engineering.

The course, which is primarily for county road officials and those having to do with highway work, but is open to all citizens who are interested, will consist of lectures, discussions and informal talks. The program is as follows:

February 7.—"The Need of Better Highways," R. C. Terrell, State Commissioner of Public Roads, Frankfort, Ky.; 'Educating the Road Sentiment," Robert E. Wood, State Director, National Highway Association; "The Road Problem of Eastern Kentucky," T. B. Webber, State Division Engineer, Pineville, Ky. .

February 8.—"Surveying for Country Roads," R. H. Reese, First Assistant Highway Engineer, Frankfort, Ky.; "Alignment and Grades," W. L. McDyre, Division Highway Engineer; "Drainage and Foundation," W. A. Obenchain, Division Highway Engineer; "Earth Road Construction," J. F. Grimes, Division State Highway Engineer, Frankfort, Ky.; "Construction and Maintenance of Gravel Roads," Walter F. Brooks, U. S. Senior Highway Engineer, Paducah, Ky.; "Construction and Maintenance of Water Bound Macadam Roads," J. A. Whittaker, U. S. Senior Highway Engineer, Hopkinsville, Ky.

February 9.—"Reconstruction of Old Macadam with Water Bound Macadam," M. D. Ross, Division State Engineer, Frankfort, Ky.; "The Farmers' Need of Good Roads," H. S. Barker, President, State University; "Testing of Materials for Macadam Roads," D. V. Terrell, Professor of Highway Engineering; "Contracts and Specifications," Mr. Whittaker; "Highway Organization," R. E. Toms, U. S. Senior Highway Engineer, Mt. Sterling, Ky.; "Construction of Brick Roads," Will P. Blair, Secretary, National Paving Brick Manufacturers' Association; "Building Country Roads with Brick," Will P. Blair; "Production and Use of Tarvia for Road Building," Philip P. Sharples, Manager, General Tarvia Department, Barrett Manufacturing Co.

February 10.—"Asphalt Binders and Bituminous Macadam," R. E. Toms, U. S. Senior Highway Engineer, Mt. Sterling, Ky.; "Treating Old Macadam with Asphalt," L. T. Haney, State Division Engineer, Louisville, Ky.; "Resurfacing with Asphaltic Concrete," George Carey, President, Carey Reed Construction Co., Lexington, Ky.; "The Use of Natural Kentucky Rock Asphalt in Road Construction," R. W. Davis, County Engineer, Fayette County; "The Production of Asphalt," J. S. Helm, Standard Oil Co., New Orleans, La.; "Construction of Concrete Roads," M. D. Ross, State Division Engineer, Newport, Ky.; "The Production of Cement and the Proper Amount to Use in Concrete Roads," O. M. Clark, Association of American Portland Cement Manufacturers; "Production, Refining and Use of Asphalt," Representative, Barber Asphalt Co.; "State Aid Roads," R. C. Terrell, State Commissioner of Public Roads; "Manufacturing of Cement and Its Use," H. B. Becker, Lehigh Portland Cement Co.

February 11.—"Design of Concrete Culverts and Slab Bridges," Rodman Wiley, State Bridge Engineer; "Design and Construction of Beam Bridges," W. E. Rowe; "Corrugated Culvert Pipe," Howard See, American Rolling Mills Co.; "Chemical Analysis of Corrugated Pipe," W. R. Fleming, Newport Culvert Co.; "The Use of the Motor Truck in the Construction of Roads," G. M. Howard, White Co.

Cornell University Postpones Good Roads Week

The "Good Roads Week" which was to have been held at Cornell University, Ithaca, N. Y., during the week beginning February 14, as noted in "Good Roads" for December 18, has been postponed until the following week.

The program, which is now in course of preparation, includes lectures and discussions on various phases of highway work and demonstrations of testing apparatus.

Street Work in New Castle, Pennsylvania

According to the report of City Engineer Milholland of New Castle, Pa., that city expended $106,535.63 for street improvements during 1915.

The city has 21.87 miles of brick and 8 miles of asphalt paving, or a total of 29.87 miles, slightly over 3 miles of which was laid during the year just ended.

The Maintenance and Repair of City Pavements*

By Geo. W. Tillson†

The American people have never appreciated the importance of keeping street pavements in good repair. The same statement is true of almost all public work. They have had too much the idea that a structure once completed needs no further attention.

As a matter of fact, all structures need constant care and repairs. This is especially true of street pavements. In fact, no city should contemplate the building of street pavements unless it also proposes to keep them in good repair. Just what it will cost to do this is uncertain. American cities, in the first place, have not kept their streets in good condition, but have spent what money they have had in making repairs. Then, too, what money has been spent has not been accounted for in such a way that the cost of each street can be known. The standard of good repairs is also different in different cities, and the cost of repairing streets will vary in accordance with that standard, as the better repair a street is kept in the less it will cost. This statement assumes that all, and not a few, of the streets will be kept in good condition, so that traffic will distribute itself naturally over the shortest and easiest routes, rather than those which are the best paved. It also makes a great difference if the streets of a city are paved with the proper material. It is manifest that if a heavy traffic street is paved with asphalt the repairs will be much greater than if it is paved with granite, and if a residential street is paved with granite the repairs will be practically nothing for a long time. If, for instance, half of the streets of a city that should be paved with stone are paved with asphalt, the total cost of keeping the asphalt pavements of that city in repair will be much more than if only those are paved with asphalt that should be so paved.

The question, too, of paying for pavements will have some bearing upon repairs. In most, if not all, of the New England cities, pavements, both original and repaving work are paid for out of the general fund of the city, while in New York the original pavement, and in most of the Western cities all pavements, are paid for by assessment upon the property owners. As has been intimated, the proper function of a city, as regards pavements, is not to pave the streets once, but to keep them paved, and the word "maintenance," as distinguished from "repairs," means the continuity of a pavement on a street, while "repairs" means simply the work necessary to be done to keep the pavement in good condition from year to year. Maintenance is the more comprehensive word and in this particular instance the greater includes the less.

In order to maintain the streets of a city in good condition and in an economical way there should be established what is known as a street improvement fund, a fund that should be continuously carried over from year to year, so that money saved in one year would be available the next. This, it seems to the writer, is so important that every city should have the right to levy a tax of a certain amount each year for the maintenance of pavements, in the same way as many cities have the power to levy a tax for school purposes. The condition of the street is extremely important in every well regulated city, and the city officials should have funds provided in sufficient amount to keep them in good condition. It is important that the fund should be continuous from year to year in order that the streets be considered as a whole, making it possible to use the money independently, expending a large or a small sum as may be necessary on any particular street to continue the pavement. When repairs are paid for out of one fund and repaving out of another this is not always possible. While it might not be practicable to adapt this principle to the needs of cities where work is done out of separate funds, still if the principle be recognized a great deal of benefit may be derived from it even under adverse conditions.

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*Extract from a paper entitled "City Pavements," presented at the recent road congress at Worcester, Mass.

†Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.

Road Building Activity Forecasted in Eastern Tennessee

The counties comprising what is known locally as upper East Tennessee are planning an active road building campaign to be inaugurated with the coming of favorable weather.

Sullivan County, which has already expended approximately $500,000, will resume work on the system of roads which it has planned.

Hawkins County has voted to expend $300,000 in the construction of a system of pikes, but the funds were provided too late to be of any material use until spring.

Work has already begun in Carter County under an appropriation of $250,000. This county has completed its section of the Bristol-to-Memphis Highway.

A large amount of money has been expended in Greene County, where there are many miles of graded roads which are to be macadamized. This work will be done during the coming season.

Washington and Johnson Counties are expected to authorize bond issues for road work. In the former county there has been more or less delay owing to complications growing out of the proposed location of new roads, but these are being cleared up.

Milwaukee, Wisconsin, Council Authorizes Extensive Street Improvement

The City Council of Milwaukee, Wis., at a recent meeting, adopted the report of the Committee on Streets and Alleys and authorized street improvements the cost of which will aggregate at least $1,500,000, according to engineers' estimates.

About two-thirds of the pavements planned under the authorization will be of asphalt.

The city's share of the cost of the new paving will be approximately $325,000, the remainder being a charge against the property benefited. Street repairs during 1916 will cost the city $143,000, according to recent estimates.

A Three-Year Road Program

At a recent special election in Snohomish County, Wash., it was voted to issue bonds to the amount of $1,813,800 for the purpose of building a system of roads. Present plans calls for the construction during the next three years of 130 miles of roads, including a gravel road from the Pacific Highway through Mukilteo to Edmonds.

Three Road Districts to Spend a Million

The Board of County Commissioners of Marion County, W. Va., have under consideration a plan for the expenditure of approximately $1,000,000 for road improvements in the districts of Lincoln, Paw Paw and Union.

Douglas County, Neb., Will Hold a Special Election on April 18 on the question of issuing $2,000,000 worth of grading and paving bonds.

The Nashville, Tenn., City Commissioners have included in the budget for 1916 $146,130 for street construction and $9,000 for opening and widening streets.

The Board of Supervisors of Monroe County, N. Y., has decided upon a program of road improvement for 1916 which includes work on 70.33 miles of county highways.

COMING MEETINGS

January 14-15—Western Paving Brick Manufacturers' Association—Annual meeting. Kansas City, Mo. Secretary, G. W. Thurston, 416 Dwight Building, Kansas City, Mo.

January 17-19—Montana Institute of Municipal Engineers—Annual meeting, Billings, Mont. Secretary and Treasurer, C. C. Widener, Bozeman, Mont.

January 18-19—Virginia Road Builders' Association.—Fifth Annual Meeting, Murphy's Hotel, Richmond, Va. Secretary and Treasurer, S. L. von Gemmingen, Assistant Engineer, Virginia State Highway Commission, Lynchburg, Va.

January 18-19—Kansas Engineering Society—Annual meeting, State Agricultural College, Manhattan, Kan. Secretary, C. A. Forter, Topeka, Kan.

January 18-20—Michigan Engineering Society.—Thirty-seventh annual meeting, Grand Rapids, Mich. Secretary, S. J. Hoexter, Ann Arbor, Mich.

January 19-22—Illinois Association of County Superintendents of Highways.—Annual convention, University of Illinois, Urbana, Ill. Secretary-Treasurer, W. E. Emery, Peoria, Ill.

January 21—American Society of Civil Engineers.—Special meeting for discussion of semi-final report of the Special Committee on Materials for Road Construction, Society House, New York, N. Y. Secretary, Charles Warren Hunt, Society House, 220 West 57th St., New York, N. Y.

January 21—American Society of Engineering Contractors.—Annual meeting, New York, N. Y. Secretary, J. R. Wemlinger, 44 Whitehall Street, New York, N. Y.

January 26-28—Illinois Society of Engineers and Surveyors.—Annual meeting. University of Illinois, Urbana, Ill. Secretary, E. E. R. Tratman, Wheaton, Ill.

January 31—Wisconsin Highway Commissioners' Association—Annual meeting, Madison, Wis. Secretary, G. H. Mainwaring, Gotham, Wis.

February 3-5—Indiana Engineering Society—Annual meeting, Indianapolis, Ind. Secretary, Charles Brossman, 1616 Merchants' Bank Building, Indianapolis, Ind.

February 9-11—Ohio Engineering Society—Annual convention, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 14-17—Connecticut Society of Civil Engineers—Annual meeting, New Haven, Conn. Secretary, J. Frederick Jackson, Chamber of Commerce Building, New Haven, Conn.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 16-18—Iowa Engineering Society—Annual meeting, Des Moines, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

The A. R. B. A. Convention at Pittsburgh

Rapid progress is being made in planning the Thirteenth Annual Convention of the American Road Builders' Association and the Seventh National Exhibition of Machinery and Materials which will be held at Mechanical Hall, Pittsburgh, Pa., February 28 to March 3.

Among the papers decided upon to date by the sub-committee in charge of the preparation of the program are the following: "Railway Tracks on Paved Streets," "Adaptability of Paving Materials," "Bituminous Surfaces for State Highways," "Concrete Roads," "Recent Tendencies in Stone Block Pavements, Especially with Respect to Size of Blocks," "Foundations," "Control of Openings in Pavements," "Roads at Low Cost for Moderate Traffic," "Effect of Motor Trucks," "Contractors' Suggestions to Engineers," "Brick Streets and Roads."

In addition to these technical papers there will be two others, both of a technical and descriptive character. One will deal with the Du Pont Road in Delaware and the other with the Columbia Highway in Oregon.

Announcement of other subjects and of the names of those who will have places on the program will be made at a later date.

The general plan of presenting the various topics which will come before the technical sessions of the convention will be the same as that which has been followed for the past few years. Each subject will be introduced by the presentation of a paper prepared by some authority on the subject dealt with. The introductory paper will be followed by a formal discussion by some especially selected speaker, after which the subject will be thrown open to discussion by the convention at large. Previous experience has shown that by this method the greatest diversity of ideas can be brought out and the proceedings made of the maximum value to all.

One innovation will be made in the conduct of the convention. This will be the devotion of an entire session to the discussion of subjects selected by vote of the members of the convention. A similar plan was tried at an A.R.B.A. convention several years ago with excellent results.

The Seventh National Exhibition of Machinery and Materials will, as in former years, include displays of practically everything in the way of equipment and material that is used in building and maintaining city streets and country roads. In no previous year have the plans for the show been so far advanced or have so many applications for space been received within so short a time after the announcement by the management that assignments of space could be made. Among those who have already arranged to make displays are some of the largest and most important road material and machinery manufacturers and dealers in the United States, so that the success of the show is already fully assured.

Road Meeting at Quincy, Illinois

A "good roads meeting" will be held at Quincy, Ill., January 25, under the auspices of the Quincy Chamber of Commerce. The general topic for discussion will be "The Necessity for Improving Adams County's Highways and Ways and Means of Doing So."

Among the speakers will be Oscar Arntz, Chairman of the Adams County Board of Supervisors; W. G. Edens, President of the Associated Roads Organizations of Chicago and Cook County; L. L. Boyer, Superintendent of Highways of Adams County, and Thomas S. Carlin, President of the Adams County Highway Commission.

Kansas Engineering Society

As noted above, the eighth annual meeting of the Kansas Engineering Society will be held at the State Agricultural College, Manhattan, Kan., January 18 and 19. The sessions will be held in the Engineering Amphitheater.

The program consists of papers and discussions on various engineering topics, those of especial interest to road engineers being as follows:

"Specifications," N. T. Veatch; "Concrete Road Construction at Kansas State Agricultural College," L. E. Conrad; "The Civil Engineer and His Opportunities," Lloyd B. Smith; "Problems of a County Engineer," W. S. Ruggles; "The County Engineer and His Relation to the Highway Laws in Our Neighboring States," H. A. Rice; "Development of the County Engineer," R. F. Gallup.

The election of officers will take place at the close of the afternoon session on Wednesday, January 19.

The annual meeting of the American Society of Engineering Contractors will be held on the evening of January 21 in the Engineering Societies Building, New York City. The program will be ready for distribution within a day or two. The annual banquet of the society will take place at the Cafe Boulevard, New York City, on the evening following the meeting.

The third annual meeting of the Pikes Peak Ocean-to-Ocean Highway Association will be held at the Commerce Club, St. Joseph, Mo., on Wednesday, February 2. There will be an election of officers and a number of matters in connection with the highway and the good roads movement in general will be disposed of. The members of the association will be guests of the Commerce Club at luncheon.

MEETING

United States Good Roads Association

The annual meeting of the United States Good Roads Association was held at the Tutwiler Hotel, Birmingham, Ala., January 11. John W. O'Neill, Vice President, presided in the absence of the President, Senator John H. Bankhead.

Officers were elected as follows: President, John H. Bankhead, Jasper, Ala.; Vice Presidents, Dell M. Potter, Clifton, Ariz.; E. J. Watson, Columbia, S. C.; John W. O'Neill, Birmingham, Ala.; Secretary-Treasurer, J. A. Rountree, Birmingham, Ala. Directors were elected to represent each of the states having membership in the association and these will elect three vice presidents from each state.

The association adopted resolutions endorsing the $25,000,000 congressional good roads bill, recommending that a system of national highways be built by the government, recommending the adoption by Congress of a national Good Roads Day, to be proclaimed as a legal holiday by the President each year, and recommending the employment of state, county, municipal and federal convicts on public roads.

PERSONAL NOTES

E. J. Stocking has been appointed Sales Manager of the Chicago Creosoting Co., Chicago, Ill.

W. L. Goodwin has been appointed Road Maintenance Engineer of the Washington State Highway Department.

William F. Schwartz has been appointed Street Commissioner of Buffalo, N. Y., under the new commission government.

W. E. Weller, who has been Acting City Engineer of Schenectady, N. Y., has been appointed City Engineer of Binghamton, N. Y.

Richard B. Williams, Jr., has been appointed Commissioner of Public Works of Syracuse, N. Y., vice Thomas H. Mather, resigned.

Paul E. Mercier has been appointed Chief Engineer of Public Works, Montreal, P. Q., to fill the vacancy caused by the death of Major Georges Janin.

NEWS OF THE TRADE

The interests of Paul N. Kingsley, bridge and culvert contractor, Strawberry Point, Ia., have been merged with those of the Dubuque Boat & Boiler Works, Dubuque, Ia. The company will carry on a general contracting business, and Mr. Kingsley will act as Construction Engineer.

Warren Bros. Co., Boston, Mass., has issued a booklet describing Warren's portable asphalt plant. The publication is printed in colors on fine paper and, in addition to the text, the 28 pages contain numerous illustrations showing the plant and various parts, as well as installations in a number of cities.

NEWS NOTES

The Election in Polk County, Fla., on the question of issuing road bonds to the amount of $1,000,000 will not be held until some time in March.

The City Council of Madison, Wis., has added $25,000 to the street improvement fund, making a total of $150,000 to be spent during the coming year.

The Board of Estimate of Milwaukee, Wis., recommends a bond issue of $4,430,000, including $240,000 for bridges and $300,000 for the construction of the Lake Shore Drive.

Preston County, Va., Will Build a Concrete Highway to connect with the Maryland state road at Oakland, Md. Bonds to the amount of $265,000 have been voted for the purpose.

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Proposed Bridge Over Delaware River Would Cost $18,000,000

A project to build a bridge over the Delaware River, from Philadelphia, Pa., to Camden, N. J., has reached a point where the Philadelphia Councils have been asked for an appropriation to defray the expenses of a commission to inquire into the feasibility of the matter.

It is proposed that the commission shall consist of the Directors of the Philadelphia Departments of Public Works, City Transit and Wharves, Docks and Ferries.

George S. Webster, Director of Wharves, Docks and Ferries, who was Chief of the Bureau of Surveys under the last city administration in Philadelphia, submitted a report to former Mayor Blankenburg, in which the cost of the proposed bridge was estimated at $18,000,000, including damages. Mr. Webster recommended a bridge of the high level type with no piers in the river.

Three Days Road School at Purdue University, LaFayette, Indiana

As announced in "Good Roads" for December 18, a road school will be held at Purdue University, LaFayette, Ind., under the direction of the School of Civil Engineering, on January 24, 25 and 26.

The first day will be taken up by the registration of attendants and by informal meetings. The program for the balance of the session is as follows:

January 25—"Construction and Maintenance of Gravel Roads," followed by a discussion; "Indiana Roads," Prof. Martin; "Maintenance of Tar Macadam Roads," Philip P. Sharples, Barrett Manufacturing Co.; "Maintenance of Grant County Tar Macadam," Charles Nelson, President County Commissioners' Association; "Brick Roads," illustrated with moving pictures; annual meeting of the State Association of Highway Superintendents.

January 26—"Construction and Maintenance of Macadam Roads," "Culverts, Small Bridges and Bridge Floors," "Dust Prevention," these papers to be followed by discussions; "Concrete Roads," illustrated with moving pictures; "The Legal Aspect of the Road Problem," followed by a discussion.

Baltimore, Maryland, Will Begin Paving Early in March

The Paving Commission of Baltimore, Md., plans to begin paving operations on or about March 1, the exact date depending upon weather conditions. As has been stated in former issues of "Good Roads," the operations will be confined principally to the southwestern, western and southeastern sections of the city.

The extent of the work will not be finally determined until legislative action is obtained on a bill permitting the capitalizing of the city paving tax. Briefly, this plan will permit the city to borrow money on the tax and continue paving operations on an extensive scale.

If favorable action by the Maryland General Assembly is secured, the city will have about $1,000,000 to spend for paving, but, if the action is unfavorable, the amount will be only a little over $500,000. It is stated that no difficulty in securing the passage of the bill is anticipated.

Wyoming County, West Virginia, to Build Earth Roads

Wyoming County, W. Va., has adopted a program of road building which contemplates the construction of a system of earth roads and involves the expenditure of approximately $550,000, according to the estimates.

The work will be done during 1916 and 1917, about half of it during each year, and will include, in addition to the road grading, the construction of culverts and other small structures and 30 bridges of from 10 to 125-ft. span.

It is expected that plans for about 15 miles of main road will be ready for contract late in February. In this section the excavation will average probably 6,000 cu. yds. per mile. There will be two 30-ft. bridges and a number of culverts.

Main roads will have a width of 16 ft. and a maximum grade of 6 per cent. In addition to these, the program contemplates the construction of secondary roads, which will be 12 ft. wide, with a maximum grade of 7.5 per cent. There will also be roads of lesser importance having a similar width, but on which a maximum grade of 9 per cent. will be permitted. In all there will be 80 miles of main roads and 120 miles of secondary roads and roads of lesser importance

Subgrade Contour for Concrete Pavements

The contour of the subgrade under concrete pavements and the reasons for the variations in design form the subject of a paper entitled "Relative Advantages of Flat and Crowned Subgrades for Concrete Pavements" presented before Section D of the American Association for the Advancement of Science at the meeting at Columbus, Ohio, on December 29, by Lewis R. Ferguson, Assistant Secretary of the Association of American Portland Cement Manufacturers.

According to Mr. Ferguson, the available data bearing on this subject contain few reports of practical value. Some of them are incomplete and unauthentic or are worthless for purposes of comparison because of the many variables which preclude the possibility of reliable deductions.

Mr. Ferguson lists six types of cross sectional design used for concrete paving. These are as follows:

"1. A uniform thickness of concrete, the subgrade being crowned the same amount as the concrete surface. This was generally adopted up to the year 1911.

"2. A greater thickness of concrete at the center than at the sides, with the subgrade flat. The County Commissioners of Wayne County, Michigan, adopted this type in 1911 and the design was followed elsewhere.

"3. A greater thickness of concrete at the center than at the sides, some crown being given the subgrade. This was fundamentally for the sake of economy in wider pavements in which reinforcement was used.

"4. A greater thickness of concrete at the center than at the sides, with the crown in the surface of the subgrade inverted. This is not a popular type but has been used.

"5. A uniform thickness of concrete, with the surface of the concrete and the subgrade each having the same amount of inverted crown. This type has been used for concrete alley construction.

"6. A greater thickness of concrete at the center than at the sides, with the inverted crown in the surface of the concrete less than that in the subgrade. This type has also been adopted for alley construction."

The first design—that of a uniform thickness of surfacing on the crowned subgrade—has long been used in road construction for various paving surfaces.

Changes in design for concrete pavements have been influenced by a number of causes, which are listed by Mr. Ferguson as (1) drainage, (2) increasing the life of the pavement, (3) economic considerations, (4) adoption for city pavements, (5) introduction of reinforcement and (6) elimination of cracks. Each of these causes is discussed at some length in the paper, the most attention being given to the elimination of cracks.

According to Mr. Ferguson, the success of the concrete pavement has been judged to a considerable extent by the prevalence of cracks. He holds that this is wrong since "cracks do not detract from the value and integrity of the pavement, if properly taken care of, except insofar as they affect the surface appearance."

Considerabe space is given in the paper to a discussion of the causes of cracks, among those taken up in detail being volumetric changes due to the hydration of the Portland cement, volumetric changes occurring, after the concrete has assumed a reasonable degree of hardness, the character of the materials in the subgrade, the rigidity of the subgrade and various obstacles in the free movement of the concrete slab.

In closing, it is stated that both the Bureau of Standards of the U. S. Department of Commerce and the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture are conducting a series of tests under various subgrade conditions to determine their importance in concrete pavement design. The hope is expressed that from the results of these it will be possible to reach definite conclusions as to the relative advantages of the flat and crowned subgrade for concrete pavements.

Deputy Highway Superintendents in Allen County, Pennsylvania

The following deputy county superintendents of highways have been appointed by County Superintendent of Highways William Tonkel, for the 14 highway districts of Allen County, Pa.:

District No. 1, 24 miles, Andrew Blum; District No. 2, 35.5 miles, Henry Kroemer; District No. 3, 32 miles, Charles Solomon; District No. 4, 55.5 miles, August Sephels; District No. 5, 31 miles, James F. Fell; District No. 6, 17 miles, William Kleber; District No. 7, 26 miles, Jacob Niff; District No. 8, 25 miles, George Meyer; District No. 9, 19 miles, Adam Eling; District No. 10, 17.25 miles, August Pape; District No. 11, 18 miles, Lewis Vanderly; District No. 12, 19 miles, Henry Young; District No. 13, 15.5 miles, Frank Killian; District No. 14, 22 miles, Frank Zimmer.

With the exceptions of the deputies in Districts Nos. 3 and 7, these are re-appointments. The appointments are for two years.

Street Improvements at Lima, Ohio

The Public Improvements Committee of the Lima, O., City Council, with the City Engineer and the City Solicitor, is considering the paving program for the coming season. Petitions have been filed for the paving of 32 streets, but it is not believed that all of the work can be done during the present year.

Portland Cement Statistics

According to a report of the United States Geological Survey, the shipments of Portland cement from the mills during 1915 amounted to 86,524,500 barrels. The production was approximately 85,732,000 barrels. The largest production was in the Lehigh district and amounted to 24,860,000 barrels. The Illinois and Northwest Indiana district was second, with a production of 10,200,000 barrels.

Work on the Pacific Highway

In addition to preparing plans and specifications for the construction of the Pacific Highway between Dupont, Wash., and the Nisqually Hill, near the line of Thurston County, County Engineer White of Pierce County, Wash., has started similar work on a 5.5-mile stretch of the highway from the end of the present pavement to the Weyerhaeuser School, leaving 40 miles of the mountain section yet to be paved. Construction will begin early in the spring.

Kankakee County, Ill., is planning for a bond issue of $750,000 for 100 miles of roads to connect all towns in the county.

The City Council of Boston, Mass., is considering an appropriation of $200,000 for widening streets in the north end of the city, in accordance with the plans of the City Planning Board.

The New York State Legislature is considering a bill providing for the taking over by the State Highway Department of Delaware Street between Buffalo and Tonawanda, N. Y. The bill calls for the repaving of the road at state expense.

The Buying of Supplies for Sharon, Pa., has been centralized in a Supply Committee. Hereafter, on all except emergency orders, heads of departments will have to make requisition on the committee at least 24 hours before purchases are made. L. C. Brainard is chairman of the committee.

COMING MEETINGS

January 25-27—Canadian Society of Civil Engineers—Annual meeting, Montreal, P. Q. Secretary, C. H. McLeod, 176 Mansfield Street, Montreal.

January 26-28—Illinois Society of Engineers and Surveyors.—Annual meeting. University of Illinois, Urbana, Ill. Secretary, E. E. R. Tratman, Wheaton, Ill.

January 31—Wisconsin Highway Commissioners' Association—Annual meeting, Madison, Wis. Secretary, G. H. Mainwaring, Gotham, Wis.

February 3-5—Indiana Engineering Society—Annual meeting, Indianapolis, Ind. Secretary, Charles Brossman, 1616 Merchants' Bank Building, Indianapolis, Ind.

February 7—Oregon Society of Engineers—Annual meeting, Portland, Ore. Secretary, H. M. Morse, Portland.

February 8-11—Second Conference on Road Construction for County Road Superintendents and Engineers—Toronto, Ont. W. A. McLean, Provincial Engineer of Highways, Toronto, Ont.

February 9-11—Ohio Engineering Society—Annual convention, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 10-12—Minnesota Surveyors' and Engineers' Society—Annual meeting, St. Paul, Minn. Secretary, George H. Herrold, St. Paul.

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 14-17—Connecticut Society of Civil Engineers—Annual meeting, New Haven, Conn. Secretary, J. Frederick Jackson, Chamber of Commerce Building, New Haven, Conn.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 16-18—Iowa Engineering Society—Annual meeting, Des Moines, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

American Concrete Institute

The preliminary program for the twelfth annual convention of the American Concrete Institute, which, as noted above, will be held in Chicago, Ill., February 14 to 17, has just been issued.

The subjects to be considered naturally cover a wide range. Those of particular interest to road builders are as follows:

Monday, February 14—Report of Committee on Nomenclature; "Cost Accounting on Concrete Work," Sanford E. Thompson, Newton Highlands, Mass.

Tuesday, February 15—"Genesis of Reinforced Concrete Construction," Prof. W. K. Hatt, Purdue University; Report of Committee on Treatment of Concrete Surfaces.

Wednesday, February 16—"Tests Showing Continued Deformation under Constant Load," Profs. A. H. Fuller and C. C. More, University of Washington; "Influence of Temperature on the Strength of Concrete," Prof. A. B. McDaniel, University of Illinois; "Tests of Reinforced Concrete," Burtis S. Brown, Consulting Engineer, Boston, Mass.; Report of Committee on Reinforced Concrete Highway Bridges and Culverts, Report of Committee on Sidewalks and Floors, "Forms for Concrete Work," R. A. Sherwin, Aberthaw Construction Co., Boston, Mass.; "Concrete Viaducts," Frank L. Raschig, Principal Assistant Engineer, Division of Structures, Department of Public Service, Cincinnati, O.; "Tests of Large Concrete Slabs by U. S. Office of the Public Roads and Rural Engineering," Earl B. Smith, Associate Mechanical Engineer, U. S. Office of Public Roads; Report of Committee on Concrete Roads and Pavements, "Concrete Foundations for Pavements for Heavy Travel," Clifford Richardson, Consulting Engineer, New York, N. Y.; "Essential Features for the Successful Construction of Concrete Highways," William M. Acheson, Division Engineer, New York State Highway Department, Syracuse, N. Y.; "The Construction of the Easton-Allentown Concrete Road," John T. Gephart, Jr., Division Engineer, Pennsylvania State Highway Department, Allentown, Pa.; "The Construction of the Toronto-Hamilton Highway by Day Labor," H. S. Van Scoyoc, Chief Engineer, Toronto-Hamilton Highway Commission, Toronto, Ont.; "The Construction of the DuPont Concrete Boulevard," Charles Upham, Chief Engineer, Georgetown, Del.; "Special Features in Pavement," R. C. Stubbs, President, R. C. Stubbs Co., Dallas, Tex.

Thursday, February 17—Report of Committee on Concrete Aggregates, "Tests of Concrete Materials at Cincinnati," Prof. G. M. Braune, University of Cincinnati; "The Chemistry of Portland Cement," George A. Rankin, Geophysical Laboratory, Carnegie Institute, Washington, D. C.; "How Shall a Rational Specification for Gravel Concrete Be Developed," C. C. Brown, Editor, "Municipal Engineering," Indianapolis, Ind.; "Tests of Sands at the Structural Materials Research Laboratory," Duff A. Abram, Instructor in Charge of Laboratory, Armour Institute, Chicago, Ill.

Ontario Conference on Road Construction

The second Conference on Road Construction for County Road Superintendents and Engineers will be held at Toronto, Ont., February 8 to 11, under the auspices of the Department of Public Highways of the Province of Ontario.

The introductory address at the opening of the conference will be delivered by Finley G. Macdiarmid, Minister of Public Works and Highways.

Following this, the regular program will be proceeded with and will cover the subjects noted below:

February 8—"Road Construction as Covered by Traffic Requirements," R. C. Muir, Assoc. M. Inst. C. E.; "Grading," A. H. Parker, B. A. Sc.; "The Organization of a Maintenance System," A. A. Smith; "The Administration of a County Road System," G. C. Parker, B. A. Sc.

February 9—"The Use of Oil as a Dust Preventive," W. Huber, Assoc. M. Can. Soc. C. E.; "Painting and Maintaining Steel Highway Bridges," George Hogarth, Assoc. M. Can. Soc. C. E.; "Special Problems in Drainage," M. A. Kemp, B. Sc.; "Roads Laws," W. A. McLean, M. Can. Soc. C. E., Provincial Engineer of Highways.

February 10—"Bituminous Road Construction," R. C. Muir; "The Care of Earth Roads and the Use of the Log Drag," W. H. Losee, B. Sc.; "Stone for Various Types of Roads," G. C. Parker; "Construction Methods on the Toronto-Hamilton Highway," H. S. Van Scoyoc, Chief Engineer, Toronto-Hamilton Highway Commission.

February 11—"The Care and Operation of Quarrying and Crushing Equipment," R. M. Smith, B. Sc.; "Resurfacing Gravel and Stone Roads," A. A. Smith; "Concrete Bridges, Culverts and Floors," Arthur Sedgwick; "The Operation and Care of the Roller," W. Huber; "Maps and Plans," T. M. DeBlois, Assoc. M. Can. Soc. C. E.

MEETINGS

Michigan Engineering Society

The 37th annual meeting of the Michigan Engineering Society was held in the Association of Commerce Rooms, Grand Rapids, Mich., January 18, 19 and 20.

Included in the program was a discussion of the general topic of "Roads," which was presided over by J. J. Cox, Assistant Professor of Civil Engineering, University of Michigan. The papers included the following:

"City Pavements," Manley Osgood, City Engineer, Ann Arbor, Mich.; "California Roads," F. F. Rogers, State Highway Commissioner, Lansing, Mich.; "Asphaltic Pavement Construction," C. A. Proctor, Asphalt Expert, Detroit, Mich.

On Wednesday, January 19, there was a joint luncheon with the Builders and Trades Association and the meeting closed with a banquet at the Association of Commerce Rooms, at which George M. Ames was toastmaster.

Public Highway Meetings in New York City

Public meetings for discussion of the semi-final report of the American Society of Civil Engineers' Special Committee on Materials for Road Construction were held at the Society House in New York City yesterday morning and afternoon.

The report contains conclusions relative to the uses of sand, gravel, broken stone, slag, brick, stone block, cement concrete and wood block in the construction of highways and descriptions of tests for the determination of physical properties of non-bituminous highway materials.

The meetings were attended by a number of engineers, contractors and manufacturers of road materials who took part in the discussions.

Alabama Association of Highway Engineers

The following officers were elected at the annual meeting of the Alabama Association of Highway Engineers held at Montgomery, Ala., January 9:

President, J. M. Garrett; First Vice-President, S. J. Cummings; Second Vice-President, M. S. Bingham; Secretary, Herbert A. Jones, Montgomery, Ala.; Treasurer, W. S. Keller, State Highway Engineer; Directors, W. O. Crisman, J. B. Converse and S. E. Fletcher.

The Southern California Association of Members of the American Society of Civil Engineers has elected the following officers: President, William Mulholland; First Vice-President, H. Haygood; Second Vice-President, Louis C. Hill; Secretary, W. K. Barnard; Treasurer, Charles H. Lee.

PERSONAL NOTES

Ossian E. Carr, who has been City Manager of Cadillac, Mich., has been appointed to a similar office in Niagara Falls, N. Y.

George H. Norton, Deputy Commissioner of the Department of Public Works, Buffalo, N. Y., has been unanimously elected City Engineer by the City Council.

F. H. Williams, who has been Superintendent of the Municipal Water and Light Plant of Brownsville, Tex., for the past two years, has been appointed Manager of the city.

Chester E. Albright, a consulting engineer of Philadelphia, Pa., has been appointed Chief Engineer of the Bureau of Surveys, Department of Public Works, Philadelphia.

D. W. Chamberlain has been appointed Engineer for the County Commission of El Paso County, Tex. He was formerly Division Engineer at Fresno, Cal., for the California State Highway Commission.

Arthur W. Kreinheder has been selected as Commissioner of Public Works, Buffalo, N. Y., to fill the vacancy caused by the death of Col. Francis G. Ward, which was noted in "Good Roads" for November 20.

Charles C. Schneider, whose reputation as a bridge engineer was international and who, for the past 14 years, was Consulting Engineer of the American Bridge Co., died January 8 at his home in Philadelphia, Pa. Mr. Schneider was a Past-President of the American Society of Civil Engineers and a member of the American Society for Testing Materials and the Engineers' Club of New York. He was the author of a number of books on bridge construction.

NEWS OF THE TRADE

The Clark & Henery Construction Co., Stockton, Cal., has opened a branch office at 746 South Main Street, Los Angeles, Cal.

The Gramm-Bernstein Co., Lima, O., manufacturers of motor trucks, has appointed C. H. Rawlins Western Sales Manager with headquarters at 736 Monadnock Block, Chicago, Ill.

The Galion Iron Works & Manufacturing Co., Galion, O., was awarded the gold medal for its collective exhibit embracing road grading machinery, at the Panama-Pacific Exposition.

The following new officers of the Virginia Portland Cement Co., Allentown, Pa., have been elected: President, Harry C. Trexler; Vice-President, E. M. Young; Treasurer, Alonzo F. Walter.

"Trailer Booklet No. 3" has just been issued by the Troy Wagon Works Co., Troy, O. It contains 16 pages of descriptive matter regarding Troy trailers and is illustrated with half tones. The cover is of heavy gray paper, printed in two colors.

Recent additions to the list of licensees of the Dunn Wire-Cut Lug Brick Co., Conneaut, O., are the Burton-Townsend Co., Zanesville, O.; the Trimble Paving Brick Co., Dayton, O., and the Thornton Fire Brick Co., Clarksburg, W. Va. These accessions give the Dunn Co. 29 licensees, operating 46 plants.

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Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Third Annual Road Institute at the University of North Carolina

Cooperating with the State Highway Commission and the State Geological and Economic Survey, the University of North Carolina will hold its third annual road institute at Chapel Hill, N. C., during the week beginning February 7. Dr. Joseph Hyde Pratt, Secretary of the North Carolina Highway Commission, is Director of the institute.

The first day will be devoted principally to registration and organization, although there will be an address on "The State Highway Commission and Its Relation to County Work," by W. S. Fallis, State Highway Engineer, and Dr. Pratt will outline the work of the institute.

The program which has been arranged for the remainder of the week is as follows:

February 8—Maintenance and Repair of Roads: Introduction, Dr. Pratt; "Patrol System of National Highways," D. H. Winslow, Senior Highway Engineer in Charge of Field Maintenance, U. S. Office of Public Roads and Rural Engineering; "Maintenance of New Hanover County Roads," W. A. McGirt, Chairman, New Hanover County Commissioners; "The Road Drag," R. E. Snowden, Highway Engineer, State Highway Commission; "The Road Hone," Mr. Winslow; Demonstration of the Construction and Use of the Road Drag, R. T. Brown, Engineer in Charge of Concrete and Bituminous Road Work, Guilford County, N. C.; Practical Instruction in Maintenance, Mr. Winslow; "Good Roads in Other Lands," Collier Cobb, Professor of Geology.

February 9—Road Construction: "Location of Roads," A. D. Williams, Chief State Road Engineer of West Virginia; "Steam Shovels," discussion by Mr. Fallis and N. C. Hughes, Jr., Road Engineer, Halifax County, N. C.; "Use of Steam Shovel in Madison County," J. B. Clingman, County Highway Engineer; "Relation of Superintendents and Engineers to Highway Commission," Mr. Williams; "Relation of Contractors to Commissioners and Engineers," R. G. Lassiter; "Road Machinery," Mr. Winslow and N. L. Teer; "County Road Work and Its Relation to State Work," Mr. Williams; "Maintenance of Roads," Mr. Winslow.

February 10—Maintenance and Repair of Roads: "Instruction to Patrolmen," Mr. Winslow; "Economic Use of Prisoners in Repair and Maintenance of Roads," H. Hocutt, Highway Superintendent; "Use of State's Prisoners in Road Construction," H. B. Varner, President, State Penitentiary Board; "Essential Qualifications for a Highway Engineer," J. N. Ambler; "Geology as an Asset to a Highway Engineer," Prof. Cobb; "Instruction in Maintenance," Mr. Winslow.

February 11—Road Surfacing Materials: "The Selection of Surfacing Materials for Highway Construction," Dr. Pratt; "Sand-Clay and Top Soil," Mr. Coble, Engineer, State Highway Commission; "Report on the Top Soil Road Between Chapel Hill and Durham," T. F. Hickerson, State Highway Commissioner; "Limit of Endurance of Sand-Clay and Top Soil Roads," Mr. Winslow; "Gravel Roads," Mr. Coble; "Macadam Roads," Mr. Fallis; "Bituminous Macadam," Mr. Brown; "Concrete," Mr. Fallis; "Guilford County Concrete and Bituminous Roads," Mr. Brown; "Bituminous Materials," Robert James, Highway Engineer; "Brick," Dr. Pratt; "Caldwell County's $1,000 Roads," Cloyd Miller, Road Superintendent; Report from county superintendents and engineers.

February 12—Culverts and Bridges: "Area of Waterway," Prof. Hickerson; "Use of Various Types of Culverts," Dr. Pratt; "Terra Cotta Culverts"; "Corrugated Iron Culverts," Mr. Gavin; "Concrete Culverts," R. T. Brown; "Rubble Masonry," Mr. Fallis; "Steel I-Beam Bridges," R. T. Brown; "Steel Truss Bridges," Mr. Fallis; "Wooden Bridges," Mr. Hickerson.

At various periods during the sessions there will be practical demonstrations of the use of road machinery and appliances used in road construction and maintenance.

Good Roads Institutes in Alabama

Good roads institutes will be held in several counties of Alabama, commencing the second week in February. The original intention of W. S. Keller, State Highway Engineer, was to hold these institutes during the present month, but the U. S. Office of Public Roads and Rural Engineering was unable to provide the services of an engineer to conduct the meetings at that time.

Conferences of Tennessee Road Officials

A series of three conferences of road officials in Tennessee have been arranged by A. M. Nelson, who was recently appointed State Highway Engineer. The conferences will be held at Knoxville, February 15 to 18; Nashville, February 22 to 25, and Jackson, February 29 to March 3. The Engineering Department of the University of Tennessee will participate in the conferences.

Public Meetings of the American Society of Civil Engineers for the Discussion of Highways

Public meetings for the discussion of the semi-final report of the society's Special Committee on Materials for Road Construction were held at the house of the American Society of Civil Engineers, New York, N. Y., on Friday, January 21. The two meetings, one in the forenoon and one in the afternoon, were attended by a considerable number of highway engineers, contractors and material men. Major W. W. Crosby, of Baltimore, Md., Chairman of the Special Committee, and Geo. W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y., and a member of the committee, presided.

The report, which was printed in the December "Proceedings" of the society, is printed below. It should be noted that the appendices, to which reference is made in the report, are omitted because of lack of space.

Progress Report of the Special Committee on Materials for Road Construction and on Standards for Their Test and Use

To the American Society of Civil Engineers,
Gentlemen:

Your special committee on "Materials for Road Construction, and on Standards for Their Test and Use," has, during the past year, endeavored mainly to consider the new field assigned to it by the Board of Direction at the annual convention in June, 1914, and to prepare for presentation, at this time, such a report on materials other than bituminous, used in road construction as would thereby place both the bituminous and non-bituminous highway materials on the same footing, in so far as the work of this committee and its duties to the society are concerned.

The demands on the time of this committee have been so great as to prevent a satisfactory revision of the semi-final report on bituminous materials submitted in 1915 and to compel it to defer such revision for another year. It is the intention of your committee during 1916 to review its reports of 1915 and 1916 and to present a revised report on both these branches of its subject to the annual meeting in January, 1917.

Semi-Final Report on Non-Bituminous Materials

Your committee first wishes to call attention to the propriety of the application to non-bituminous materials of many of the conclusions submitted in its semi-final report on bituminous materials used in highway work, and, in order to avoid unnecessary repetition thereof in this report, it recommends reference to its report of a year ago, and the application of all its conclusions, therein expressed, as may be proper in this connection, to non-bituminous highway materials, in addition to the specific statements hereinafter made.

A considerable variety of non-bituminous materials and of methods of using them exists in highway construction and maintenance. Some of these materials have been in use for many years, and some of the practice in the test or use of them has become fairly well standardized. On the other hand, many of the materials are new, and more or less change has occurred in their tests or use, and is even now taking place. Local conditions have had much to do with the selection of the material and the determination of the particular method to be followed in any specific case.

Your committee has considered it impracticable to attempt to cover all the various non-bituminous road materials in this report, but has considered especially what seem to be the more important ones. It believes that many of the questions affecting the selection or use of these materials can only be solved by a better knowledge of their characteristics or qualities and more complete records along uniform lines of their behavior in use. It, therefore, recommends that the needed information concerning the materials be secured along the lines laid down under the various headings, in order that conclusions of value may be reached and a general agreement in the records thus obtained.

As in its work on bituminous materials, your committee has attempted to initiate and encourage the collection of comparable records concerning non-bituminous highway materials by arranging, for the purpose, forms which will be widely distributed to highway authorities. Copies of these forms will be found in Appendices A and B.

The committee, recognizing the importance of the factor of costs, both first and subsequent, in almost all pavement questions, has, for the same reasons, attempted to initiate and encourage the collection of comparable records of cost figures by the preparation of forms for this purpose. Copies of these forms will be found in Appendix A. Both these forms apply to the particular material or methods used on specific areas of road or street surfaces. For comparisons of cost figures in connection with the study of relative costs between streets or considerable sections of a traffic route, your committee reiterates the recommendations contained in its report of Jan. 20, 1915, under the heading, "Collection and Standardization of Cost Data." It should also be noted that the traffic data provided for in the part of Appendix A relating to cost data are not intended to supplant those given under traffic census.

In submitting its conclusions, your committee has, for convenience, arranged them under separate classifications. It should be distinctly understood that the committee has deliberately refrained from including in this report such conclusions regarding any material or method as appear to have been generally agreed on. On the other hand, no conclusions have been stated unless supported by a substantial majority of the committee's membership.

Your committee offers such conclusions (other than its forms referred to) as it has been able to reach during the past year on non-bituminous highway materials as follows:

General.—Your committee considers it still of sufficient importance to warrant the repetition here of its previous statements to the effect that there is no such thing as "the most satisfactory roadway surface" or as a "panacea" for all highway ills, and that the proper selection of the particular material and methods of construction to be used, which will most efficiently meet the conditions of any particular case, is the real problem to be solved.

Your committee recommends that the selection of the kind of crust or pavement be based on the following factors, the special value of which may be estimated in each case under the local conditions of traffic, surroundings, climatic conditions, and physical and financial resources, both as to construction and maintenance, with proper regard for probable or possible changes in these circumstances: First cost, maintenance cost, annual cost (interest on first cost plus maintenance cost plus annuity), ease of maintenance (facility of making repairs), durability, cleanliness, tractive resistance, slipperiness, favorableness to travel, sanitariness (especially when not properly cleaned), noiselessness, and appearance.

Broken Stone and Slag Roadways.—The size of stone in the wearing course should be as large as practicable, but not so large as to lead to its being dislodged under traffic.

Within limits, the softer or more cementitious the stone used for the wearing course the larger its size should be.

The size of stone in the bottom course should be within the maximum limit which will insure its stability under traffic and other stresses, and may be of any size that will result in the economical use of the crusher product.

The utmost possible compaction of the courses, before the addition of the void filling material, is desirable.

Thorough filling of the otherwise irreducible voids is desirable, and a slight excess of the void filler on the surface of the wearing course will usually be found to be of value.

For a water bound broken stone roadway, the void filler should be clean stone screenings or sand, and the use of clay should be avoided. A proportion of fine mineral material, between certain maximum and minimum sizes, which proportion and sizes will depend largely on the character of the materials used, is desirable.

For water bound roadways of some limestone or of some slags, it will be advisable wherever practicable to use for one-half the void filler a non-cementitous material, such as clean sand, with the other half of the finer particles of the material itself.

Dense, tough slag is preferable to the more porous or to the vitreous varieties, and it should be free from metallic pieces.

Such proportions of the various sizes of material used as will result in the greatest possible density of the roadway, when properly compacted and bound, are desirable.

Gravel Roadways.—The conclusions expressed under the head of "Broken Stone and Slag Roadways" apply in a general way to gravel roadways, except as follows:

With rounded gravel the tendency toward dislodgment under traffic is greater than with angular broken stone, and hence, for equal resistance to this tendency, the size of the pieces in the courses of the roadway must be somewhat smaller with gravel than in the case of broken stone.

With gravels such as quartz, the cementation of which is extremely low, a highly cementitious void filler is desirable, and a moderate quantity of clay in sand used for filling the interstices of water bound gravel surfacing may be advantageous where the water and frost action on the roadway surfacing is not too severe.

Where the roadway is constructed of run-of-bank gravel, it is desirable to obtain a gravel which will contain enough stone of the larger size to insure stability and wearing qualities under traffic, and which contains sufficient finer material to insure a proper bond.

The committee is of the opinion that uncarpeted roadways should be used only for light traffic.

Cement Concrete Pavements.—The subgrade for a cement concrete pavement should always be as carefully prepared, rolled and compacted as for any other roadway and should be made to conform to the proper lines and grades.

The value of a sand layer under cement concrete pavements, to allow for expansion and contraction, appears as yet to be undetermined, and further experimental data bearing on this point are desired.

Expansion joints, when provided in a roadway slab or pavement, should be designed and installed so as to interrupt to the minimum degree practicable the uniformity of the surface; should be placed at intervals of approximately 30 ft.; and may be built with advantage at an angle of from 70 to 80 degrees with the axis of the road.

Too much emphasis can not be laid on the importance of frequent testing of the materials. This testing should include, not only the cement, but also the fine and coarse aggregates. The most desirable fine aggregate is that which is properly graded from the maximum sized particles downward, so as to have the greatest density.

The importance of thoroughly mixing the concrete is of such great moment that it can hardly be over-emphasized. The denser the concrete, other things being equal, the greater will be its strength and value. Every effort should be made to obtain by proper proportion and workmanship the greatest density practicable, under the existing conditions of any case, and the proportions of the various ingredients should be rationally determined and not be arbitrarily dictated or assumed.

Uniformity of character and composition being a most desirable quality of the completed pavement, every effort must be made to meet and offset the various tendencies toward non-uniformity particularly prevalent in concrete work, such as variations in proportions of sizes and materials, segregation of the mix during its preparation, and variation in compaction, setting and drying of the mass.

In all cases the surface of the finished pavement should be kept wet and, if possible, protected from the sun for several days.

Brick and Slag Block Pavements.—Toughness, resistance to wear from shock or abrasion, and non-absorption are essential qualities. The first two can be determined by the standard rattler test, and the last by the customary absorption test through immersion in water. Uniformity in the rate of wear is equally important, and may properly be a controlling consideration, even at the expense of a moderate sacrifice in the rate of wear.

Although the use of sand joints may occasionally appear to be justified, in the interest of economy, it is unwise to use them when some additional first cost will result in appreciably prolonging the life of the pavement. Cement joints, when properly made, will maintain the integrity of the surface, but uniformity in the cement grout and special skill and care in its application are essential to success.

Such form of the individual brick or block is desirable as will automatically provide sufficient, but not too wide, joints, and as will insure uniformity in their width, even when they are laid rapidly and with ordinary care.

The thickness of the sand cushion often used is excessive. The function of this cushion is to give some resiliency to the wearing course, and to allow for irregularities in the surface of the concrete foundation and for unavoidable variations in the depth of the brick or block. As the variation in depth (of the brick or block) decreases, the thickness of the sand cushion can be corerspondingly decreased. If the variation in the depth does not exceed ½ inch and if the surface of the concrete foundation is sufficiently even, a cushion course 1 in., or even ¾ in., in depth will be enough.

The committee recommends further investigation of the possible use of a bituminous cushion and a cement mortar bed in place of the sand cushion for brick and slag block pavements.

Stone Block Pavements.—The recent and present tendencies toward smaller and better dressed blocks should be encouraged, to the end that closer joints between the blocks may be had and that greater uniformity in the thickness of the cushion under the blocks may be secured. Under average conditions, for a given class of pavement, stone blocks used in various parts of America should, in the interests of low first cost and economical manufacture, comply with the same requirements relative to dimensions and dressing of the several faces.

The thickness of the sand cushion often used in excessive. The function of this cushion is to give some resiliency to the wearing course, and to allow for irregularities in the surface of the concrete foundation and for unavoidable variations in the depth of the block. As the variation in depth (of the block) decreases, the thickness of the sand cushion can be correspondingly decreased. If the variation in the depth does not exceed ½ in., and if the surface of the concrete foundation is sufficiently even, a cushion course 1 in. in depth will be enough. The committee recommends further investigation of the possible use of a bituminous cushion in place of the sand cushion for stone block pavement.

Stone block pavements should generally be laid on a cement concrete foundation, but in case of temporary paving, any type of well drained, stable foundation may be used.

Stone blocks should be composed of medium or fine grained granite or sandstone having a percentage of wear of not more than 4.5, and a toughness of not less than 8. Sandstone and granite for stone blocks should have crushing strengths of not less than 16,000 and 20,000 pounds per sq. in., respectively.

As it is desirable to secure a suitable waterproof wearing course for pavements, sand should never be used alone as the joint filler. A bituminous filler may be preferred to a cement grout filler on account of the lower cost of street opening repairs, the better foothold provided for horses, and the securing of a more resilient and, hence, less noisy pavement.

The utilization of recut stone blocks has been demonstrated to be capable of producing economical and satisfactory results, and should be encouraged.

Wood Block Pavements.—There is no general necessity for confining the material for wood paving blocks to long leaf Georgia pine (pinus palustrus).

Such form and shape of the individual block, or such method of laying as will insure the placing of the blocks with the fiber normal to the surface of the pavement and provide uniform joints, even when the blocks are rapidly and not over carefully placed, are desirable.

Experience has demonstrated that an excessive quantity of preservative involves additional cost without compensating advantages, and, if too little is used, it may fail of its purpose. Under normal conditions, it would appear that not less than 15 nor more than 20 lbs. per cu. ft. should be used.

No necessity exists, in the case of a wood block pavement, for a resilient cushion under the blocks, and the reduction of any provision for a cushion or bed, in or on which the blocks may be laid, to such a layer as may be necessary safely for the purpose of correcting the unevennesses of the foundation and of permitting the immediate compensation for irregularities in the depths of the blocks themselves, is desirable. It is also desirable that such an intermediate layer between the foundation and the blocks shall be of such character as will insure its permanence in the position it occupies when the pavement is opened to traffic.

In filling joints, three different materials have been used, and all have their advocates. Although it is possible that all are good under different circumstances, neither experience nor experiment has made it certain which one is the best.

Your committee wishes to take this opportunity to express its appreciation of the interest shown in its previous report, and of assistance given the committee by those who contributed discussion on it. It regrets that, as stated, pressure of other matters has prevented proper consideration of the criticisms or discussion offered, up to this time, but, during the coming year, it hopes to be able to digest properly the suggestions made, and thereupon to embody revised and further conclusions in its next report.

The committee wishes to express again its deep appreciation of the assistance given it by the Board of Direction, and by the Secretary, Mr. Charles Warren Hunt, as well as by the members of the society and others.

Very respectfully,

W. W. CROSBY, Chairman;
H. K. BISHOP,
A. W. DEAN,
N. P. Lewis,
C. J. Tilden,
G. W. Tillson,
A. H. BLANCHARD, Secretary.

Special Committee on
Materials for
Road Construction, etc.

Discussion on the Report

Discussion on the report was taken up by topics in the order in which they were treated in the report. Two written discussions had been sent in, one by C. R. Mandigo, Assistant City Engineer of Kansas City, Mo., and the other by P. E. Green, Consulting Engineer, Chicago, Ill., and the portions of these dealing with each of the topics were read during the discussion of those topics by Professor A. H. Blanchard of Columbia University, Secretary of the committee and of the meeting.

Broken Stone and Slag Roadways and Gravel Roadways.—These pavements, though taken up in the report under two headings, were considered together. Among the points made in P. E. Green's discussion was that oil is not an unmixed blessing as it keeps water out of the road and it is believed that some water is beneficial, especially in a stone road. Mr. Mattimore said that the meaning of "clean stone screenings" in the report should be explained more fully as it might be taken to mean screenings free from dust—the real binder. He also objected to the specification for the cementation test for stone, and doubted the value of the test for crushing strength.

It should be noted that the specifications for tests referred to here and to which reference is made elsewhere were printed in the appendices of the report, which, as previously noted, space does not permit reproducing here.

The question of using sand as a binder for broken stone roads was brought up by James H. MacDonald, former State Highway Commissioner of Connecticut, who argued that sand should not be used in water bound macadam. Major Crosby pointed out that the committee recommended it only with limestone and some slags and did not say whether or not sand should be used with materials other than limestone.

R. A. Meeker, State Highway Engineer of New Jersey, said that he favored the use of courses of different sized stone instead of the use of one course of graded aggregate in a gravel road if the gravel were over 2 ins. in size. Mr. MacDonald, on the other hand, favored laying the material in courses in either water bound macadam or gravel road construction and using as little foreign binder as possible. A. N. Johnson, of the Bureau of Municipal Research of New York City, suggested laying the material as it came from the quarry and then harrowing it in place. He said this caused the finer material to go to the bottom, and that it was cheaper than grading the stone and shipping in two sizes. Mr. McGovern said that two different grades of stone from the quarry were seldom alike as to the size of the material as the smaller sizes would be carried over in the screen and would be found mixed with the larger sizes, especially when the crusher was crowded.

Cement Concrete Pavements.—K. H. Talbot, Assistant Inspecting Engineer of the Universal Portland Cement Co., objected to the use of the word "crust" and suggested that the word "pavement" be used for all surfaces. He said that he agreed with the committee's recommendations relative to expansion joints except that he did not believe that the joints should be put in at an angle as it was difficult to strike off in such cases and there was also the possibility of cracks at a sharp angle. Mr. Talbot also expressed the belief that the consistency of the concrete is of great importance and that it should be considered in the report. The last paragraph under the heading "Cement Concrete Pavements," Mr. Talbot believed, should be amended by striking out the words "if possible," as he held that all concrete roadways should be protected from drying out. Mr. Meeker suggested that it be specified that the surface "must" be kept wet instead of "should be kept wet," and that the words "if possible" be stricken out. He also stated that in his opinion the first paragraph under "Cement Concrete Pavements" should be amended to specify that the subgrade for the cement concrete pavement should be more carefully prepared, rolled and compacted than for any other roadway.

Mr. Kinney expressed the belief that thorough mixing is one of the most important factors in the construction of concrete roads and that the consistency of the concrete is also of the greatest importance.

Mr. Mattimore said that there was such a variety of opinion as to the distance between expansion joints that he did not believe the committee should specify a distance.

In reply to a question by J. C. Bentley, Percy H. Wilson, Secretary of the Association of American Portland Cement Manufacturers, said that dikes to retain water on the top of a concrete slab had been used for curing concrete roads and that the method was advantageous. [This method of curing concrete roads was described and illustrated in "California State Highways," by Austin B. Fletcher, Highway Engineer of the California Highway Commission, printed in "Good Roads" for September 4, 1915.—Ed.] Mr. Wilson, in referring to the last paragraph under "Cement Concrete Pavements," stated that the "several days" specified should be at least 14 days.

The written discussions by Messrs. Green and Mandigo favored pavements without expansion joints, and in Mr. Mandigo's discussion attention was called to the necessity of careful preparation of the subgrade, the belief being expressed that the subgrade for the concrete pavement should be prepared more carefully than for any other pavement.

Mr. Talbot said that he was convinced that the lack of joints results in cracks and that joints should be put in. Mr. Kinney said that he believed that reinforcement should be used if joints were not put in. He also pointed out that if the angle were very acute a triangular piece of concrete at the side was likely to break off, and he, therefore, believed that the angle should be very nearly a right angle.

E. H. Thomes, Assistant Engineer, Bureau of Highways, Borough of Queens, New York, N. Y., and Mr. Wilson did not believe that metal protection plates were necessary at expansion joints. Mr. Kinney stated that there was still room for considerable argument as to the use of metal plates, and that he did not believe that engineers at present were in a position to say that such plates were not necessary.

Brick and Slag Block Pavements.—The subject of brick and slag block pavements was the first topic taken up at the afternoon meeting. Prevost Hubbard, Chemical Engineer, U. S. Office of Public Roads and Rural Engineering, who was the first speaker, discussed the tests at some length and urged that bituminous fillers be recognized.

Wm. H. Connell, Chief of the Philadelphia Bureau of Highways, spoke of the difficulty of getting bituminous fillers into the joints without smearing the pavement, and he expressed the belief that if this smearing could be avoided the bituminous filler would be very satisfactory.

Wm. C. Perkins, Chief Engineer, Inspection Department, Dunn Wire-Cut-Lug Brick Co., suggested that the committee strongly recommend a paving brick of standard size and recommended that the surface dimensions be 8½ by 3½ ins. He said that the present standard depth was 4 ins. but that there was a question of reducing this to 3½ or even 3 ins. He said that he was very glad the committee had seemed to favor cement filler, for while he did not claim that to be perfect it was the best that could be used at present. He said that the sand for the grout filler should be graded, that the water should be regulated carefully, and that the cement and sand should be mixed before the water was added. Mr. Perkins said that he could never see the reason for the sand cushion. He said he was glad that the committee had advised the reduction of the depth of the sand cushion to 1 in. and hoped that it would report to eliminate the sand cushion altogether and substitute a cement-sand bed containing one part of cement to three, four or five parts of sand, laid dry, the bricks to be watered before grouting. He pointed out that with the elimination of the sand cushion the thickness of the brick could be reduced, with a consequent considerable saving in freight charges.

In discussing testing, Mr. Perkins stated that he did not advise the testing of individual bricks as there was generally no wide variation in results.

J. W. Howard, Consulting Engineer, New York, N. Y., discussed tests at some length. He argued that the hardness test should be made on the material itself and not upon the finished brick, and that individual bricks should be tested. In reference to changing the depth of brick, he said that he did not believe it would be wise because of the necessity for maintaining pavements laid with 4-in. bricks.

In reply to a question by Mr. Connell, Mr. Perkins said he believed the rattler test the best test now in use.

In the written discussions by Messrs. Green and Mandigo, the value of the absorption test was questioned and the belief was expressed that too deep a sand cushion is specified.

J. E. Myers, Chemist, New York State Commission of Highways, suggested that in the specifications for testing brick provisions should be made for drying them before making the rattler test. He also stated that the absorption test usually checks the rattler results.

Major Crosby said that the committee in preparing the tests had included all those which it felt might be of value. The committee was aware of the opinion that the absorption test is superficial, but felt that this was perhaps not sufficiently proven to warrant the elimination of the test.

H. B. Drowne, Instructor in Highway Engineering, Columbia University, asked if the acceptance or rejection of bricks in accordance with individual tests would or would not tend to increase the price of paving brick. Major Crosby cited experience in Maryland work to show that with tests on individual bricks the price need not be considerably greater as it would be possible to use different grades of brick under different kinds of traffic, the prime requisite being to secure uniform brick in any one piece of work.

Mr. Connell agreed with Major Crosby that different qualities of brick might be used for different pavements. He also referred to plant inspection, stating that plant inspection was made on practically all material except brick. In reply to this Mr. Perkins stated that the manufacturers welcome plant inspection.

Stone Block Pavements.—The principal points discussed in connection with stone block pavement were the filler to be used and the tests to be specified. In the written discussion by Mr. Green, it was stated that cement grouted stone block pavements were less noisy than those with bituminous fillers because the edges of the brick did not become rounded and that a grouted stone block pavement became less noisy with age, while the opposite was true of one with bituminous filler.

Mr. Mattimore expressed the belief that the test for crushing strength is not necessary and advised the use of the hardness test in the Dore machine.

Mr. Howard called attention to the committee's recommendation that "stone blocks should be composed of medium or fine grained granite or sandstone having a percentage of wear of not more than 4.5, and a toughness of not less than 8," and suggested the substitution of the term "uniform grained granite, free from laminations" instead of "medium or fine grained granite." He also favored recutting old granite blocks and using them again.

H. W. Durham, formerly Chief Engineer of Highways of the Borough of Manhattan, New York, N. Y., stated that he agreed with Mr. Howard in regard to the specification of the kind of granite. He also expressed the belief that the hardness test was not of great importance as he had found all of the granites commonly used in Manhattan street work to test very high. In regard to the filler to be used, he stated that he believed that the question of using bituminous or cement grout could well be left open for the present. He said that he believed careful dressing of the blocks to be most important and that he favored the use of recut blocks.

R. A. MacGregor, Assistant Engineer, Bureau of Highways, Borough of Manhattan, New York, N. Y., said that in Manhattan a mixture of sand and bitumen had been used for filler and that the difficulty had been to get a uniform mixture into the joint.

E. H. Thomes said that he beileved it was an advantage to mix the sand and asphalt for joint fillers at the plant.

Wood Block Pavements.—In the written discussion by Mr. Green, it was urged that a light oil is a better preservative than a heavy oil but that it has some disadvantages, notably its tendency to evaporate. He also stated that there was no need of a cushion for the blocks. In the written discussion by Mr. Mandigo, the necessity for thorough and uniform treatment of the block was emphasized.

J. W. Howard said that if the cushion course were used it should be of coarse sand, but that he personally favored the cement and sand cushion. M. B. Greenough, Instructor in Civil Engineering in the Case School of Applied Science, expressed the belief that a cement and sand cushion should be used. He also described at some length the experimental work being done at the Case School. Mr. Howard discussed the matter of preservatives at some length.

Wisconsin Highway Commission to Hold Road School

The Wisconsin Highway Commission will hold its fifth annual road school in the Assembly Chamber of the Capitol at Madison, Wis., from January 31 to February 5. The annual meeting of the Wisconsin County Highway Commissioners' Association will be held in connection with the school.

Aside from the usual registration and organization, which will occupy most of the first day of the session, there will be an address by State Engineer J. G. D. Mack on "The Function and Possible Benefits of Road Schools," and A. R. Hirst, Chief Engineer of the Wisconsin Highway Commission, will review the work done during 1915. There will be a smoker in the evening.

The program for the remainder of the week is as follows:

February 1—"Financing Road Improvements," John A. Hazelwood, Chairman, Wisconsin Highway Commission; "The Geology of Wisconsin, and of Its Road Materials," W. O. Hotchkiss, State Geologist; "The County Clerk and the Highway Movement," S. H. Woods, President, Wisconsin Association of County Clerks; "The New State Aid Law; Powers and Duties of Various Officials," A. R. Hirst, Chief Engineer, Wisconsin Highway Commission; "The County Trunk Line System of State Road Construction," J. T. Donaghey, Chief Inspector, Wisconsin Highway Commission; Debate: "Resolved, That Under Wisconsin Laws and Conditions, the Contract System Is the Best System for Performing State Road Construction." Affirmative: Messrs. Kuelling, Morisset, Moore, Pearcey and Parker. Negative: Messrs. Gillespie, Dillon, Ubbelohde, Cauley and Jeffries.

February 2—"Proper Locations and Necessary Relocations," discussion led by J. T. Donaghey, Chief Inspector, Wisconsin Highway Commission; "Concrete Culverts and Bridges," discussion led by W. M. Conway, Division Engineer, Wisconsin Highway Commission; "Earth Roads," discussion led by F. M. Sergeant, Division Engineer, Wisconsin Highway Commission; "Sand-Clay, Clay-Sand, and Shale Roads," discussion led by S. P. Hall, Division Engineer, Wisconsin Highway Commission; "Water Bound Stone and Gravel Macadam Roads," discussion led by F. M. Balsley, Division Engineer, Wisconsin Highway Commission; "Concrete Roads," discussion led by H. J. Kuelling, County Highway Commissioner of Milwaukee County; "The Panama Canal," F. E. Turneaure, Dean of the College of Engineering of the University of Wisconsin; "Typical Wisconsin Bridges," M. W. Torkelson, Bridge Engineer, Wisconsin Highway Commission; "Typical Wisconsin Roads," J. T. Donaghey, Chief Inspector, Wisconsin Highway Commission.

February 3—"The Maintenance of Bridges—Paints," discussion led by W. C. Buetow, Division Engineer, Wisconsin Highway Commission; "The Maintenance of Earth Roads; Dragging; Patrol Systems, etc.," discussion led by John H. Mullen, Assistant State Highway Engineer of Minnesota; "The Maintenance of Gravel and Stone Macadam Roads—Resurfacing, Surface Treatments, Patrol System," discussion led by A. R. Hirst, Chief Engineer, Wisconsin Highway Commission; "The Maintenance of Concrete Roads," discussion led by Frank Whitlow, Superintendent of Construction, Milwaukee County.

February 4—County Highway Commissioners' Day—Topics for Discussion; Equipment, Organization and Policy, Construction Problems; Business Meeting of the Wisconsin Highway Commissioners' Association.

February 5—"The Essential Features of a Road Contract," W. C. Owen, Attorney-General; "Construction Accounts and Reports," discussion led by J. E. Gillespie, Division Engineer, Wisconsin Highway Commission; "Requirements for 1916," A. R. Hirst, Chief Engineer, Wisconsin Highway Commission; "Merit System and Highway Work," John A. Hazelwood, Chairman, Wisconsin Highway Commission.

PERSONAL NOTES

L. E. Hunt, Principal Assistant City Engineer of San Francisco, Cal., died recently at his home in that city.

A. M. Nelson, M. Am. Soc. C. E., has been elected State Highway Engineer by the Tennessee State Highway Commission.

William B. Ruggles, a prominent engineer and head of the Ruggles-Coles Engineering Co., New York, N. Y., died January 23 of pneumonia, at his home in Bergen Point, N. J.

D. L. Teal has been appointed Highway Engineer of Jefferson County, Ia., to succeed A. F. Fischer, whose appointment to another position is noted elsewhere in this column.

A. F. Fischer, who was Highway Engineer of Jefferson County, Ia., has been appointed Highway Engineer of Johnson County, Ia. He will have charge of all road and bridge construction.

MEETINGS

At its annual meeting held at New Orleans, La., January 8, the Louisiana Engineering Society elected the following officers for the ensuing year: President, Samuel Young, Vice President, A. T. Dusenberry; Secretary, W. T. Hogg; Treasurer, E. H. Coleman; Director, Rufus S. Manley.

The annual meeting of the road supervisors of Washington County, Pa., was held at Charleroi, Pa., January 27. The program included addresses by State Highway Commissioner Cunningham, W. A. Wynn, Maintenance Engineer, Bureau of Township Highways, and A. B. Gray, District Engineer, State Highway Department.

COMING MEETINGS

January 31—Wisconsin Highway Commissioners' Association—Annual meeting, Madison, Wis. Secretary, G. H. Mainwaring, Gotham, Wis.

February 3-5—Indiana Engineering Society—Annual meeting, Indianapolis, Ind. Secretary, Charles Brossman, 1616 Merchants' Bank Building, Indianapolis, Ind.

February 7—Oregon Society of Engineers—Annual meeting, Portland, Ore. Secretary, H. M. Morse, Portland.

February 8-11—Second Conference on Road Construction for County Road Superintendents and Engineers—Toronto, Ont. W. A. McLean, Provincial Engineer of Highways, Toronto, Ont.

February 9-11—Ohio Engineering Society—Annual convention, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 10-12—Minnesota Surveyors' and Engineers' Society—Annual meeting, St. Paul, Minn. Secretary, George H. Herrold, St. Paul.

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 14-17—Connecticut Society of Civil Engineers—Annual meeting, New Haven, Conn. Secretary, J. Frederick Jackson, Chamber of Commerce Building, New Haven, Conn.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 16-18—Iowa Engineering Society—Annual meeting, Des Moines, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

Ohio Engineering Society

The annual meeting of the Ohio Engineering Society will be held February 9, 10 and 11, at the Ohio State University, Columbus, O., as noted above.

The program has not been completed, but among those who have promised papers are Clinton Cowen, State Highway Commissioner; W. A. Stinchcomb, Maurice B. Greenough, C. E. Sherman, F. W. Patterson, T. J. Smull, E. G. Bradbury and H. P. Cumming.

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THE COMING A. R. B. A. CONVENTION AT PITTSBURGH

While at the present writing all the arrangements for the Pittsburgh convention of the A. R. B. A. have not been completed, the plans are far enough along and more than sufficient interest has been evinced to show conclusively that the meeting will be a success.

As noted in previous issues, the technical sessions are to be conducted along those lines which have proven so successful in former years. As is customary at the A. R. B. A. meetings, the topics chosen for consideration are those in which road builders are most interested. They all deal with questions that are encountered in the everyday work of the road builder and that are of direct financial as well as scientific interest to him. While, in some instances, those who will present papers will be men who are new to A. R. B. A. conventions as speakers, they will all be men most eminently qualified to deal with the subjects assigned to them, and the same will be true of the leaders of the discussions which will follow the papers.

It is proposed to devote one entire session this year to the consideration of topics selected by vote of the delegates. This is expected to bring forth particularly valuable discussions, as was the case when a somewhat similar plan was adopted some years ago. It is recognized that some of the most valuable contributions to the deliberations of meetings of this kind are included in the informal discussions, and it was with this in mind that the method outlined was decided upon.

The show, as in past years, will be an important adjunct to the convention. The displays at the Good Roads Show include practically everything in the way of equipment and materials used in building and maintaining country roads and city streets. Excellent facilities have been provided for the display of the exhibits, and the number and character of the applications for space have been such as to insure the success of the show. The exhibitors include many of the largest and most widely known road machinery and material manufacturers and dealers in the United States, and the exhibits, therefore, are certain to be both varied and of the greatest practical value to those whose work includes the use of road building equipment.

Unusual credit is due to those in charge of the arrangements this year, for they have worked under greater difficulties than ever before. As the majority of our readers know, the A. R. B. A., during the past two months, has been the subject of no little harsh criticism, which, we believe, has been uncalled for. The association has not answered these attacks publicly, doubtless feeling secure in leaving the facts, which have been set forth from time to time, as an adequate answer to its critics. Those who, for reasons of their own, have seen fit to attempt to injure the organization have made every effort to do so by obstructing the plans for the Pittsburgh convention, and it speaks well for the place which the A. R. B. A. has won for itself that these efforts have proved entirely unsuccessful.

BRICK PAVEMENT CONSTRUCTION METHODS

Among some highway engineers the use of a mortar or sand and cement bedding course instead of the usual sand cushion for brick wearing surfaces is rapidly gaining favor. An article dealing with this subject at some length is printed on other pages of this issue.

A considerable portion of the article consists of statements by well known highway engineers relative to these new methods. In these statements the engineers have set forth their opinions, based either upon their experience or their observations. While the majority favor the substitution of some other method of construction for that involving the sand cushion, the different engineers, as might be expected, are not unanimously in favor of such a step. As a matter of fact, neither of the two proposed alternative methods of construction has been in use long enough and under close enough observation to permit of final judgment at this time. Any method of construction, before it is finally accepted as the best, must be tried out through a long period during which the most complete and careful records must be kept of traffic, climatic and other conditions affecting its use, the methods and cost of maintaining the pavement and repairing it, and all other pertinent data. With such records and a full knowledge of the method employed in the original construction, and its cost, intelligent comparison can be made with other types and definite conclusions drawn.

Whether or not either the monolithic method of construction or the sand and cement bedding course is to supersede the sand cushion is a question which merits the most careful consideration of engineers. At present, very decided opinions are held on both sides, while many engineers are inclined to await further developments before passing judgment. This course seems to be the best and every encouragement should be given to further experimentation and study.

THE SHACKLEFORD FEDERAL AID BILL

Federal aid for the construction of "rural post roads" is provided for in a bill (H. R. 7617) recently passed by the House of Representatives of the United States. A resume of the measure is printed on another page of this issue, and we urge its consideration by our readers.

For some time it has seemed likely that legislation of this sort would be enacted by the Sixty-Fourth Congress. "Good Roads" has always advocated the state aid principle, believing that the public roads could be improved satisfactorily by that method. It has been recognized, however, that federal aid has been favored in many sections of the country and that this sentiment would sooner or later become strong enough to bring about the passage of legislation committing the government to road work. At the same time, it has been the contention of "Good Roads" that such action should not be taken until the country was ready for it and until sufficient time had been taken for study of the question and the preparation of a bill that would provide for an equitable distribution of the benefits and a fair division of the financial burden.

It is not certain that the Shackleford bill provides for these. Under its provisions a certain specific amount is apportioned to each state and of the balance one-half is apportioned on the basis of population and the other half on the basis of road mileage. In the committee report on the bill is printed a table showing the total amounts which would be apportioned to each of the several states. These sums vary from $101,102 for Nevada to $1,594,412 for New York. One of the chief arguments for federal aid has been that it was needed by states of large area having few roads and small populations and which were, therefore, handicapped in their efforts for road improvement by the immense amount of work to be done and the limited resources with which to do it. If this argument is valid, a state like Nevada, for instance, is more in need of federal aid and in need of more federal aid than is New York. On the other hand, it is sometimes argued that the states which have done the most road work are the ones most deserving of aid, and it is more nearly in accordance with this method of distribution that the provisions of the Shackleford bill would operate.

"Good Roads" offers no solution of the problem of distribution of the federal funds. It has no solution nor has it seen any satisfactory solution. The problem is very intricate, and its difficulties have been pointed out in these columns more than once. It is believed that the matter should be most carefully considered by some body of experts who should be provided with facilities and given sufficient time to arrive at a conclusion in accordance with the principles of engineering, finance and law involved in the problem.

By the terms of the Shackleford bill, the Department of Agriculture is charged with the duty of supervising federal aid work. The present organization of the department is not adequate for this task, and, while this could be overcome by the establishment of a proper bureau or division of the department, the whole method of federal supervision is one which should be covered more specifically than it is in the present bill. There is much force in the argument that the federal government should have supervisory power over any work for which its funds are expended, but, at the same time, it is highly undesirable to vest too much authority in the central government in such work as road improvement.

A most serious objection to the bill is that it provides for a very large expenditure from funds for which there are many uses. The country has been led to believe that, in view of the unsettled condition of foreign relations and the need of money for national defense, the usual drain of federal funds to provide "pork" would be materially reduced at this session of Congress. With this in mind it is difficult to find justification for the appropriation of any considerable sum of money to enable the government to embark upon a course of doubtful expediency. Certainly, such work should not be undertaken except under the very best law that can be drawn. The Shackleford bill does not seem to us to be the best measure that could be formulated, even with the data now at hand. In many quarters it is regarded as a shrewd piece of partisan politics, and nothing more.

There is at hand no information to indicate what likelihood there is that the bill will pass the Senate and be approved by the President, but it is hoped that the bill will not become law until it has been modified in certain respects.

The County Commissioners of Dade County, Fla., will sell $275,000 worth of road and bridge bonds which have been voted for work in District No. 2, on February 7.

The Board of Works of Newark, N. J., has abandoned the plan to widen Market Street owing to the cost of the work which was estimated at $1,287,000. Chief Engineer M. R. Sherrerd has been instructed to work out another plan for relieving traffic congestion.

A Paved Highway Between Detroit and Chicago was the topic considered at a recent banquet tendered by the Battle Creek Sanitarium to the Michigan Detroit-Chicago Highway Association. About 300 delegates attended the banquet, according to reports, and an organization was effected with the following officers: President, A. B. Williams, Battle Creek; Secretary, O. T. Towne, Kalamazoo, and Treasurer, Norman Flowers, Jackson. The proposed highway, it is stated, will pass through Ypsilanti, Ann Arbor, Jackson, Battle Creek, Kalamazoo, Dowagiac and Niles, Mich., and Michigan City, Ind.

PITTSBURGH'S STREETS

POINT DISTRICT OF PITTSBURGH AND THE NORTH SIDE, FROM MT. WASHINGTON—ONE END OF BUILDING IN WHICH A. R. B. A. CONVENTION WILL BE HELD SHOWN AT EXTREME RIGHT.

Pittsburgh, Pennsylvania, selected by the American Road Builders' Association as the place of the organization's thirteenth annual convention, is a city in which visiting engineers will find much to interest them. Though its street work will naturally come first in their consideration, there are many other public works that will claim attention.

Pittsburgh proper has a population of 570,000 and an area of 41.61 sq. miles. The population of Allegheny County, in which the city is situated, is over a million.

The city is divided into three distinct sections by the Allegheny and Monongahela Rivers, which unite at the "Point" to form the Ohio. These sections are that portion of the city north of the Ohio and Allegheny Rivers, which includes the former city of Allegheny and is known as the North Side; peninsular Pittsburgh, which lies between the Allegheny and Monongahela Rivers and includes what is known as "Old Pittsburgh," and the territory south of the Monongahela and Ohio Rivers, comprising several sections. Among the latter mention may be made of Birmingham, generally called the South Side; West End, comprising those sections lying on the lower ground; Duquesne Heights, Mt. Washington, and other sections on the hilltops. The development of the city and the natural and artificial barriers arising from the character of the topography and the construction of railroads has further divided the city into numerous subdivisions, each having a business section of more or less extent. The main business section of the city is situated in the so-called "Point" district—that is, in the trianguar strip between the Allegheny and Monongahela Rivers, extending to 11th St. on the Allegheny and Ross St. on the Monongahela River frontage. In addition, it includes important business and warehouse districts on the South Side and North Side, which are directly connected with the Point district by bridges.

The growth of the city by the development of more or less independent communities centering around various industrial establishments and the character of the topography have united to made the problem of providing adequate highways connecting the business sections with the outlying districts and furnishing a means of intercommunication among the different districts one of the greatest with which the city has had to cope. The solution has included not only the construction of new highways, but also the reconstruction of existing thoroughfares which have become inadequate for the traffic because of their prohibitive grades or their narrowness. The city officials and various civic organizations have devoted much study to this and other municipal problems, and in 1911-12 bonds to the amount of $14,000,000 were issued to improve the highway system, to improve and enlarge various main sewerage systems and to extend and improve the city's water supply.

Under the laws and ordinances governing the performance of public work in Pittsburgh the cost of original street improvements, including grading, paving, curbing and sewering, is assessed, to the extent of the resulting benefit, upon abutting property. The deficiency in the funds so provided, which averages 10 per cent., is borne by the city and may be paid either out of annual appropriations of funds secured from general taxation or by special bond issues. Damages and benefits are assessed by the Board of Viewers, which is appointed by the court, and is governed by the provisions of the state laws relating thereto, by precedent, and by court decisions. In apportioning the cost of improvements the value of the property, the damages resulting and the benefits accruing are taken into consideration, and it follows, therefore, that the percentage of cost assessed against the city, which represents the difference between the total cost and the amount assessable against the abutting property varies through a wide range.

There are two methods by which street improvements may be initiated—first, by a petition of a majority in interest and number of abutting property owners; and, second, under the provisions of what is known as the "Act of 1895," by an ordinance requiring a three-fourths vote of the members of the Council. The latter method is resorted to only when the general interest of the community at large will be served, as in the case of providing through routes for traffic, in the case of necessity because of sanitary reasons and other causes of a like nature. The cost of trunk sewers and main branches is borne almost entirely by the city, being met from funds provided by bond issues or by annual appropriations. The city bears the entire cost of street repaving, maintenance and repair. Extensive work of this kind, such as widening, relocating and changing the grade of the streets upon which the original improvements have been made, is generally financed by special bond issues.

The construction and maintenance of all public works is in charge of the Department of Public Works, the organization of which is shown in one of the accompanying illustrations. The two bureaus in this department having to do chiefly with street work are the Bureau of Engineering and the Bureau of Highways and Sewers. The Bureau of Engineering has charge of all street improvements; sewerage and drainage work; bridge construction, maintenance and repair; and special investigations and reports regarding projected public improvements. The Bureau of Highways and Sewers has supervision and control of street cleaning, the repairing of street pavements, footways, board walks and steps, the maintenance and repair of sewers, the maintenance of boulevards, and snow removal. The Bureau of Engineering is divided into divisions as shown in the chart, each division having charge of certain work. For the purpose of carrying out the work of the Bureau of Highways and Sewers the city is divided into seven highway districts, each in charge of a district superintendent, a general foreman and assistant foremen, with such other employees as are necessary.

The present Director of the Department of Public Works is Robert Swan, who is the executive and administrative head of the department. The Chief Engineer is N. S. Sprague, and the Assistant Chief Engineer is Wm. E. Gelston. The heads of the various divisions of the bureau are as follows: Streets, T. M. Reed; Bridges, T. J. Wilkerson; Design, Chas. M. Reppert; Sewers, I. Chas. Palmer; Public Utilities, Geo. W. Schusler. U. N. Arthur is Principal Assistant Engineer of the Division of Surveys, and J. S. Praegner is Chief Clerk. The inspection of all construction work in the city, such as paving, sewers and bridges, is in charge of a force of inspectors under Chief Inspector J. T. Aston. Bridge maintenance is taken care of by a force of bridge carpenters, painters and laborers in charge of J. T. Gray, General Foreman.

The Superintendent of the Bureau of Highways and Sewers is John F. O'Toole; the Assistant Superintendent is T. Lloyd Pillow, and the Superintendent of Municipal Asphalt Plants is James D. Strain.

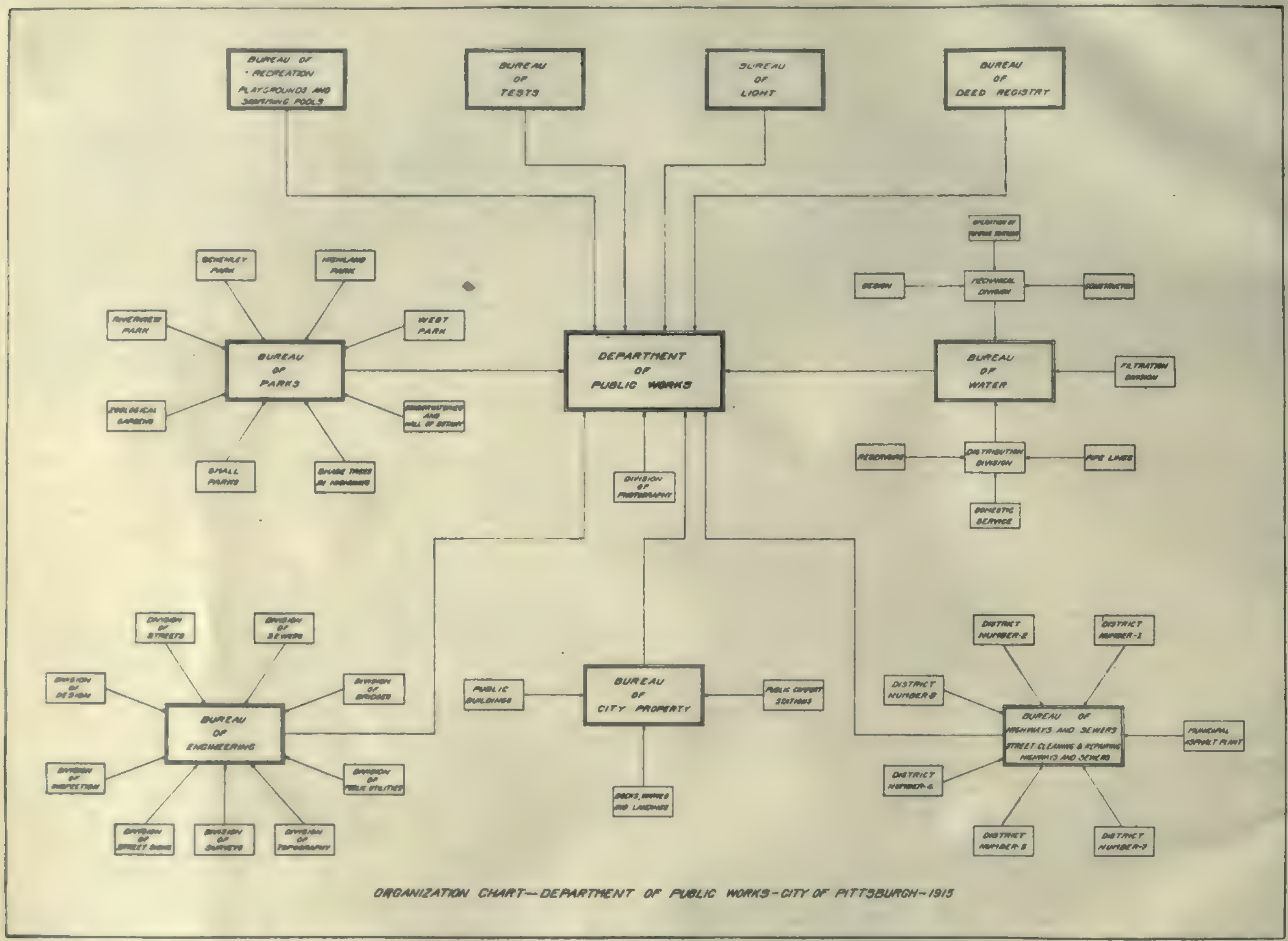


CHART SHOWING THE ORGANIZATION OF THE DEPARTMENT OF PUBLIC WORKS OF PITTSBURGH, PA.—BUREAUS HAVING TO DO WITH STREET WORK AT LOWER CORNERS.

During recent years the work of municipal betterments has been carried on in accordance with a broad and comprehensive policy. The work has been varied and has consisted largely of such street improvements as grade reductions, the raising of flooded areas, the widening, realigment and the reimprovement of main thoroughfares, the elimination of grade crossings, extensive bridge construction and reconstruction, and improvements to the drainage system. One of the most important of these improvements was the work done in the section known as the "Hump District." This work comprised the lowering of grades throughout an area of about 20 acres in the downtown business district. The maximum cut, which was made at the intersection of 5th and Wylie Aves., was over 16 ft. The grade at 5th Ave., the

WEST CARSON STREET IMPROVEMENT DURING CONSTRUCTION—TYPICAL RETAINING WALL AT RIGHT.

NORTH PORTAL OF THE CORLISS STREET TUNNEL UNDER THE P. C. C. & ST. L. R. R.

principal thoroughfare in the business district, was reduced from 7.6 to 4.87 per cent., between Grant and Smithfield Sts. In connection with this improvement, several streets in the same district were widened, among them Oliver Ave., Cherry Way, Diamond St. and 5th Ave. In addition, Grant Boulevard was extended from its former terminus at 7th Ave. through to Webster Ave., thus securing an excellent main thoroughfare by the way of Webster and Oliver Aves. The execution of the Hump cut work involved the regrading and widening of streets, the reconstruction of the sewerage system, the relaying of water pipes, the reconstruction of the surface and subsurface structures of public service corporations and extensive changes in abutting buildings. Before going ahead with the work the city secured waivers of damages from nearly 80 per cent. of the property owners affected. Funds for carrying on the work were secured by special bond issues, which in their total amounted to $765,000. The total cost of the improvement has amounted to $3,165,000. The actual work cost the city $765,000, as noted, and the damages, as determined to date, amounted to $2,400,000. In addition to the expenses included in the $3,165,000, there are other costs which will undoubtedly reach a high figure, such as the cost of the work done by public service companies and the cost to private property owners who signed waivers of damages.

Other important improvements which have been carried out since 1911 include extensive work in raising streets in the lower portions of the city. Periodical flooding of low-level territory along the rivers, involving serious damage to property, interruption of business and traffic and the producing of unsanitary conditions, has been one of the most troublesome problems with which the city has had to deal. The control of rivers and the prevention of floods has been extensively studied by the Flood Commission, which recommended the construction of a system of dams and storage reservoirs. As a part of the general plan the city has undertaken extensive street raising projects and has completed this work in sections of the North Side, in the West End and in the Penn Ave. and Duquesne Way district. This work has been done at considerable cost to the city, private property owners and public service companies. The streets have been raised above the highest flood stages, and the results have been so satisfactory that the near future will probably see a continuation of the street raising program. The physical cost of the contracts executed by the city for the raising and reimprovement of the streets in the flooded district of the North Side, comprising a total area of over 40 acres—much of it in the business and warehouse section—was $205,000. Similar work in the West End district, including resewering and the construction of a section of sanitary intercepting sewer, cost $147,000.

Still other work done during the period mentioned included improvements on West Carson, South 18th and Corliss Sts. West Carson St. is a main thoroughfare connecting the business district of the city with outlying sections on the Ohio River. The section improved extended from South Main St. to the city line at Chartiers Creek, the work done consisting of widening, relocating and reimproving. The

WEST LIBERTY AVENUE—VIEW BEFORE STARTING IMPROVEMENT WORK.

WEST LIBERTY AVENUE AFTER WIDENING, GRADING AND PAVING.

"HUMP CUT" WORK IN PROGRESS—FIFTH AVENUE, BETWEEN ROSS STREET AND WYLIE AVENUE.

work was attended by considerable difficulty on account of the restricted space available, the street being situated between the tracks of the Pennsylvania Lines at a high elevation on one side and the tracks of the Pittsburgh & Lake Erie Railroad at a lower elevation at the other. An idea of the conditions encountered and the type of retaining walls used extensively on the contract can be had by reference to one of the accompanying illustrations. Over a mile of reinforced concrete retaining wall was built in making this particular improvement.

The South 18th St. improvement also included the construction of extensive retaining walls.

The improvement of Corliss St. included the construction of a highway tunnel under the Pennsylvania Railroad. The tunnel is 40 ft. in width and received special architectural treatment, the side walls being lined with special brick and the portals ornamented as shown in the accompanying illustration of the tunnel.

In accordance with the policy of municipal improvements which has heretofore been followed, it is planned to proceed with extensive projects in the near future. Bonds will be issued to meet the city's portion of the cost of the following improvements:

Reimprovement of streets, involving, generally, the widening, reimprovement and repaving of existing thoroughfares	$2,600,000
Repaving and repairing of street pavements	501,000
Improvements to main drainage systems	351,000
Construction of three highway bridges	609,000
Extension and general improvement of the water supply and distribution system	1,500,000
Improvements to parks and playgrounds	402,000
Total	$5,963,000

"HUMP CUT" WORK IN PROGRESS ON WEBSTER AVENUE, EASTERLY FROM SEVENTH AVENUE.

Street Pavements

As shown in the accompanying table of the mileage of various kinds of pavements in the city of Pittsburgh, the pavements most used are stone block, sheet asphalt and vitrified brick. The high percentage of stone block pavement is due to the steep grades which prevail in many sections of the city. Wood block pavement is gradually replacing stone block in the business section and on heavily traveled thoroughfares, so that the percentage of this type is constantly increasing. In general, the stone and wood block pavements are the types most used in the business sections of the city, while in the residential sections the most common types are sheet asphalt and vitrified brick.

TABLE I—MILEAGE OF VARIOUS KINDS OF STREET PAVEMENTS IN THE CITY OF PITTSBURGH, JAN. 1, 1915

Kind of Pavement	Miles
Stone block—limestone	237.78
Stone block—granite	2.20
Sheet Asphalt	194.17
Vitrified brick	74.77
Cobblestone	15.63
Macadam	9.59
Irregular stone block	3.59
Creosoted wood block	2.43
Asphalt block	1.36
Concrete	0.50
Total	542.02

Stone Block Pavement.—The blocks used for paving are principally those known as Ligonier blocks. They vary in depth from 6 to 7 ins., and are laid on a sand cushion from 2 to 3 ins. thick on a 6-in. concrete foundation. The joints are filled with bitumen, gravel or Portland cement grout, as specified. The first cement grouted stone block pavements were laid during 1915, the work being done on a number of large contracts, including the West Liberty Ave. improvement and also the improvement of a number of streets in the downtown business section, notably Penn Ave. and Duquesne Way. West Liberty Ave., before and after improvement, is shown in two of the accompanying illustrations.

FIFTH AVE. LOOKING FROM GRANT ST. TOWARD SMITHFIELD ST.—AFTER COMPLETION OF "HUMP CUT."

Wood Block Pavement.—Yellow pine blocks have been generally used in the wood block pavements of Pittsburgh. The blocks are 3½ ins. deep and have an average length of 8 ins. They are laid on a ½-in. cement mortar bed on a 6-in. concrete foundation, except on bridges. Both light and heavy oil treatments have been used, the present specifications requiring that the preservative shall be an oil having a specific gravity of from 1.03 to 1.08 and that the amount used shall not be less than 16 lbs. to the cu. ft.

Sheet Asphalt Pavement.—Prior to 1914 standard sheet asphalt pavement was laid with a 2-in. wearing surface and a 1-in. binder course of the open type. Radical changes have recently been made in the specifications, however, and the present specifications call for a close binder and a scientific grading of the sand. The wearing surface is now made 1½ ins. thick and the binder course 1½ ins. thick, the concrete foundation being 6 ins. thick. In order to meet the sand grading requirements of the new specifications it has been necessary to import about one-third of the sand from the lake districts.

Vitrified Brick Pavement.—Vitrified brick pavements are laid on a 1½-in. sand cushion resting on a 6-in. concrete foundation. Both bituminous and cement grout fillers have been used for the joints. Hillside brick are used on steep grades.

Concrete Pavement.—Concrete pavements have recently been laid to a limited extent in alleys. The mix used consists of one part cement, two parts sand and three parts gravel.

Curbing.—During recent years steel protected concrete curbing has very largely replaced sandstone curbing. The standard concrete curb is 6 ins. thick at the top and is protected by a 3x2x⅜-in. angle, secured to the concrete by anchor bars. The curb is laid on broken stone and may be either built in place or molded in sections and laid in the same manner as stone curbing.

Street Improvements in 1915

ROADWAY AND LIGHTING STANDARDS ON THE BAUM BOULEVARD BRIDGE OVER THE P. R. R.

TABLE II—SUMMARY OF STREET, BRIDGE AND SEWERAGE IMPROVEMENTS IN 1915

Character of Work	No. of Contracts	Amount
Repaving of streets	22	$ 150,400.00
Grading, paving and curbing of streets, original improvement	19	703,900.00
Sewer construction	54	287,900.00
Bridge construction and repair, exclusive of bond issue work	16	63,200.00
Construction of retaining walls and miscellaneous contracts	8	36,600.00
		$1,242,000.00

During 1915 contracts amounting to a total of $1,242,000 were awarded for street, sewer and bridge work. A summary of these contracts, which do not include bond issue work, is given in the accompanying table. Included in the improvement work done during the year was the grading, paving and curbing of West Liberty Ave., to which reference has previously been made. Work under the contract was started March 5, 1915, and completed Jan. 15, 1916. The cost was $365,000, exclusive of damages. Another important contract was one awarded early in the year for the raising of low-level streets in the Penn Ave.-Duquesne Way section in the downtown business district. The territory involved included Penn Ave., from the "Point" to 11th St., a distance of nearly a mile, and Duquesne Way on the Allegheny River, from Barbeau St. to Anderson St., a distance of about half a mile. The grades of these streets, together with those of intersecting streets and alleys, range in elevation from 33.3 ft. to 33.9 ft. The maximum change of grade was 8.4 ft. and the total length of streets and alleys affected was 2.3 miles. The pavements laid in this improvement were wood block and grouted stone block. The contract for the work was awarded on April 23, 1915, and was completed on Dec. 1, 1915. The total cost of the physical work executed by the city was about $215,000. The amount of damage has not yet been determined.

GENERAL VIEW OF THE LARIMER AVENUE REINFORCED CONCRETE ARCH BRIDGE.

An interesting feature of this improvement is the storm drainage system installed. Because of certain restrictions contained in the waivers of damages, which were secured from about 75 per cent. of the property owners, it was necessary to establish level grades for considerable distances on Penn Ave., Duquesne Way and other streets. The sewerage system, which was an old one, was peculiar in that most of the sewers were located on streets perpendicular to the Allegheny River, and there were few sewers, except private, inadequate ones, on the main streets parallel to the river. It was, therefore, necessary to install a special drainage system on Penn Ave. and Duquesne Way. This consisted of special storm sewer inlets connected with tile drains, which discharged into manholes connected with existing combined sewers by traps.

Another important piece of work done during the year was the improvement of Hamilton Ave. in the East End residence district. This work consisted of improving the street to a width of 60 ft. between Frankstown and 5th Aves.

REINFORCED CONCRETE ARCH BRIDGE CARRYING BUTLER STREET OVER HETH'S RUN.

The improvement extended the city's system of main thoroughfares and afforded a direct line of communication between two residential districts, traffic between which had previously been obliged to make a long detour.

Street Cleaning

The chief function of the Bureau of Highways and Sewers is that of cleaning public highways. This work involves the routine operation of patrol cart cleaning, machine flushing, machine sweeping, hose flushing and street sprinkling. As in other American cities, the lack of uniformity in the character and kind of street paving in Pittsburgh gives rise to cleaning problems which have to be solved by the close study of conditions in given sections of the city. The total cost of cleaning highways during 1914 was $393,269.11. This amount was expended for work on 542 miles of improved streets and alleys, including a pavement area of 7,537,221 sq. yds.

Street Repair

Next to street cleaning the most important work performed by the Bureau of Highways and Sewers is that of repairing all public roads, except those streets paved with asphalt. More than one-half of the amount expended by the bureau for repairs was used for the repair of unimproved highways. Large sections of undeveloped territory, which are being developed for residential purposes, have been brought within the boundaries of the municipality by the annexation of contiguous boroughs and townships. The building operations incidental to this development create conditions on unimproved highways that require large and continual expenditures to insure safety and to keep the streets in such condition that they may be used for traffic. The work includes grading, ballasting, the construction of box drains, the maintenance of gutters and other incidental work.

Asphalt Repairs and Repair Plants

The municipality owns and operates two asphalt repair plants, one situated at Dallas Ave. and the Pennsylvania Railroad in the East End district and the other on South Ave. in the North Side. The maintenance work on asphalt streets upon which the contractors' guarantees have expired is performed by these plants. The East End plant takes care of the work on streets between the rivers, and the North Side plant takes care of the work in that section of the city formerly known as Allegheny. A total of 418,723.60 sq. yds. of asphalt pavement was laid by these plants in 1914. Of this amount, the East End plant (Plant No. 1) laid 357,148.02 and the North Side plant (Plant No. 2) laid 61,575.58. The average cost of the work done by the East End plant was $0.8672 per sq. yd. and that of work done by the North Side plant $0.878 per sq. yd.

The North Side plant has a rated capacity of 2,000 sq. yds. of completed asphalt pavement in a 10-hour working day, with an equivalent capacity of asphaltic concrete. The plant was completed in 1914 at a total cost of $53,000, exclusive of land. The plant is conveniently located for delivery by river, railroad or motor truck, and is housed in a steel building. The machinery includes two rotary driers, each of a rated capacity of 25 tons per hour; three 14-ton melting kettles; two air compressors; two 15-ft. mixers; one 12,000-gal. flux tank, with heating coils; a 150-H.P. horizontal tubular boiler, fired with gas, and a 125-H.P. engine. The plant is belt driven.

Bridges

Because of the rivers and the rough and broken character of the land, especially in the outlying sections of the city, the development of the highway system has necessitated the construction of a large number of bridges spanning rivers, valleys, and railroad tracks. The highway improvements of recent years have made necesary not only the building of new bridges, but the reconstruction of old bridges, many of which had become inadequate or were in an unsatisfactory structural condition. Previous to 1908 most of the bridges were steel structures, with wooden floors. Later work has consisted largely of the construction of reinforced concrete bridges, mostly of the arch type, this form being adopted not only for the sake of permanency, but also with a view to enhancing the appearance of the structures. The Meadow St. Bridge, which was completed in 1910, was the first bridge of this type. It was rapidly followed by others, among which is the Larimer Ave. Bridge, having a main span of 312 ft. The Larimer Ave. Bridge, which is shown in one of the accompanying illustrations, is of the open spandrel, hingeless arch type and is the longest bridge of this kind in the United States. Data on the concrete arch structures of the city are included in Table III.

TABLE III—CONCRETE ARCH BRIDGES IN PITTSBURGH.

Bridge	Cost	Date Started	Date Completed	No. of Main Spans	Length of Span (ft.)	Total Length (ft.)	Approaches	Type of Main Span
Meadow St.	$71,500	3/ 1/10	11/11/10	1	210.00	454.00	3 21-ft. spans each	3-ribbed, open spandrel
Larimer Ave.	167,100	5/ 2/11	11/22/12	1	312.00	670.00	3 and 4 30-ft. spans	2-ribbed, open spandrel
Baum Blvd. over P.J.R.R.	93,700	8/30/11	4/ 5/13	1	180.00	418.33	1 45-ft. and 1 60-ft. span	2-ribbed, open spandrel
Baum Blvd. over P.R.R.	94,300	3/11/11	6/17/13	3	98.00	380.00	Filled abutments	Arch ring, filled spandrel
Hoeveler St.	28,700	7/ 8/11	6/10/13	1	60.70	164.10	Filled abutments	Arch ring, filled spandrel
Murray Ave.	97,900	5/12/13	8/21/14	1	210.00	375.00	2 and 4 15-ft. spans	2-ribbed arch, open spandrel
Haights Run	136,000	5/19/13	5/26/15	1	195.00	327.00	Hollow abutments	2-ribbed arch, open spandrel
Approaches to N. S. Point Bridge	280,000	1/ 9/14	10/ 8/15	8	40.33 to 85.00	1778.00	Retaining walls; earth and slag fill	Arch rings, hollow spandrel

In addition to the concrete bridges shown in the table, there are several steel bridges of recent construction which should be noted. The new North Side Point Bridge over the Allegheny River, which was completed in 1915, replaces an old wooden bridge built some years ago. The new structure has two steel main spans and concrete arch and retaining wall approaches. Each steel span is 531 ft. long and has a clearance of 70 ft. above the river. The north approach is 862 ft. long and the south approach 925 ft. The cost, including the approaches, was about $1,000,000.

The Bloomfield Bridge, over the tracks of the Pennsylvania Lines and the Pittsburgh Junction Railroad, is a steel structure of the deck viaduct type, with a main span, of the cantilever type, 400 ft. long. It forms a means of communication between Grant Boulevard and the section known locally as the Bloomfield District. The bridge carries a 34-ft. roadway and two 8-ft. sidewalks. It was completed in 1914 at a cost of $365,000.

The Sylvan Ave. Bridge, which is practicaly completed, is of the plate girder viaduct type and replaces an old structure. It carries Sylvan Ave. across a ravine in which are situated the tracks of the Pittsburgh Junction Railroad and a number of low-level streets. Its cost will be about $93,000.

The Supervision of Public Utilities

One of the most troublesome questions arising in connection with the maintenance of city highways has been solved by the creation of a division in the Bureau of Engineering, which, under the terms of a general ordinance, has supervision over all work done on the highways under the supervision of public service corporations or individuals. Formerly openings in street pavements, especially those made by plumbers and others for the purpose of making service connections, caused rapid deterioration of new pavements, because the work was done by irresponsible and inexperienced workmen who were in no way liable for repair. By the terms of the ordinance under which the new division works, pavements may be opened only after application has been made and a permit secured from the proper city officials, a bond filed and a guarantee given that work will be done satisfactorily and that payment will be made for all damage done. Permanent repairs are made by the city 60 days after the completion of the work, and in the meantime the pavement is maintained by the applicant. A charge is made on the basis of 3 sq. yds., according to a fixed schedule varying with the class of pavement. Where an opening larger than 3 sq. yds. is required, an excess charge per square yard is made.

During 1915 the city derived about $75,000 from this source.

Grade Crossing Elimination

Until recently, there were grade crossings in the city which constituted a menace to life and interfered with the movement of traffic on important thoroughfares. The city has taken up the abolishment of the principal grade crossings, securing the necessary funds by bond issues and acting jointly with the different railroad companies and also with the street railway -

The Mayor and the Principal Officials of the Bureau of Public Works, Pittsburgh, Pennsylvania.

ROBERT SWAN,
Director.

N. S. SPRAGUE,
Chief Engineer.

T. LLOYD PILLOW,
Assistant Superintendent, Bureau of Highways and Sewers.

JOSEPH G. ARMSTRONG,
Mayor.

JOHN F. O'TOOLE,
Superintendent, Bureau of Highways and Sewers.

WM. E. GELSTON,
Assistant Chief Engineer.

GEORGE W. BURKE,
Superintendent of Parks.

GENERAL VIEW OF THE NORTH SIDE MUNICIPAL ASPHALT PLANT, PITTSBURGH, PA.

companies where the tracks of the latter were involved. The elimination of the crossing at 2d Ave. and Try Way was completed in 1913 at a cost to the city of about $130,000, exclusive of damages, and at a total cost to all parties of $350,000, also exclusive of damages. The tracks of the Pennsylvania Lines crossed the street at grade, and the plan adopted involved raising the tracks and depressing the street.

The elimination of the Homewood grade crossings was completed in 1914. This was part of a comprehensive project, since the raising of the railroad tracks and extensive street work was necessary in outlying boroughs. At several places within the district streets crossed the Pennsylvania at grade. A joint agreement was made between the city and the railroad company, and the latter raised the tracks a maximum of about 8 ft., the streets being depressed. The cost to the city was about $230,000 and to the railroad company about $260,000, making the total $490,000.

Work is now in progress on the elimination of the crossing at 33d St. and Liberty Ave., where at present the tracks of the Pittsburgh Junction Railroad cross at grade. The street, which carries a heavy traffic, is to be lowered slightly and the railroad elevated. In this case the city contributes a lump sum of about $150,000; the traction company contributes a lump sum, and the railroad pays the balance.

Testing Laboratory

All physical and chemical tests of materials used by the city are made by the Bureau of Tests, which is in charge of M. S. Evans, Director of Tests. This laboratory takes care of all materials, including not only those used by the Department of Public Works, but also those used by other bureaus and departments. Research work is also carried on by the laboratory and some important work has been done with paving materials, particularly those used in the construction of asphalt and wood blocks. A valuable feature of the laboratory is the system of keeping records showing the life and qualities of materials used in construction, particularly in street paving.

TYPICAL DRIVEWAY IN SCHENLEY PARK, PITTSBURGH, PA.

City Parks

The city of Pittsburgh has an extensive park system, embracing 26 parks having a total area of 1,320 acres. In the development of the individual parks every effort has been made to preserve the natural beauty of the landscape and at the same time meet the requirements of the public for amusement and recreation. Data on the park system are contained in the Table IV. The park system is under the supervision of the Bureau of Parks, of which George W. Burke is Superintendent.

TABLE IV.—PARK SYSTEM OF PITTSBURGH—TABULAR DATA

Name of Park	Acreage	Miles Roadway	Miles Bridle Path	Miles Walks	Streets in Vicinity
Schenley	422.00	7.00	6.00	7.50	Forbes, P. J. R. R.
Highland	366.00	5.50	0.62	9.35	Beechwood, Butler
Arsenal	19.90	0.58	...	1.00	Penn, 39th
Lawrenceville.	4.70	...	...	0.35	Butler, 46th
Central	5.00	...	...	0.35	Bedford, Ledlie
Herron Hill...	13.00	...	...	0.38	Adelaide, Madison
Washington Sq.	4.25	...	...	...	Bedford, Elm
Friendship ...	2.00	...	...	0.14	Friendship, Gross
Bluff	4.60	...	...	0.78	Bluff, Seneca
McKinley	63.00	1.24	0.13	2.31	Michigan, Delmont
Grandview ...	18.00	...	...	1.10	Bailey, Tank
Mt. Washington	12.00	...	...	...	Grace
Olympia	9.18	...	...	0.65	Virginia, Hallock
Holliday	3.50	...	...	0.39	Oneida, Pawnee
West End.....	17.50	0.86	...	0.33	Walbridge, Kerr
West Park.....	100.00	0.26	...	4.30	Western, North
Monument Hill	17.00	0.20	...	0.30	Ridge, Thomas
Riverview	240.00	4.88	0.35	3.00	Perrysville, Observatory
Total.......	1,321.63	20.52	7.10	32.23	

Government Experiments on Concrete for Road Building

The government, through the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, has recently undertaken a series of experiments for the testing of concrete in road construction.

Included in the tests which will be made is the determination of the proper thickness of concrete foundations. This work will be done at Arlington, Va., and will consist of the construction of slabs of varying thicknesses on several kinds of subgrade and the testing of these to destruction by loads applied through various paving surfaces.

Other experiments will be conducted for the purpose of determining what kind of aggregate is the most economical under different traffic conditions. There is a noticeable difference in the amount of wear on concrete road surfaces now being built, and in order to obtain data on this an instrument to determine the amount of wear on concrete roads of different types has been constructed in the concrete laboratory at Arlington. With this, periodical measurements will be taken on concrete road surfaces on which traffic conditions are known.

It is also stated that it has long been known that concrete is not elastic but is permanently deformed under loads. In the tests on reinforced concrete slabs recently made by the Office of Public Roads and Rural Engineering, it was noted that the concrete continued to deform slowly as long as the load was applied, and in order to study this phenomenon more fully a series of tests has been commenced for the purpose of determining the "flow" of concrete and reinforced concrete under direct compression and bending stresses.

Methods of Brick Pavement Construction

Recent Development of the "Monolithic" Type and the Mortar or Cement-Sand Cushion

Paving methods, while differing in detail in various localities and under the supervision of different engineers, are in general sufficiently standardized so that radical departures from the usual methods are not of common occurrence. For this reason, when any method which does differ materially from those regarded as standard is employed in some particular piece of work and is subsequently adopted more or less extensively in other work, the results are watched very closely by the highway engineer. At present, one of the most important variations in practice is the elimination of the sand cushion in the brick pavement, and the substitution therefor of a bed of cement mortar or cement and sand or, in some cases, the bedding of the brick paving blocks upon a very thin film of sand and cement spread over the green concrete base, this latter method producing a pavement which is practically a monolithic structure.

It should be noted that where the intermediate course consists of sand and cement instead of sand alone, the course may be either a slightly moistened sand and cement mixture or may be a true mortar.

LAYING BRICK IN CONSTRUCTION OF "MONOLITHIC" TYPE OF PAVEMENT AT PARIS, ILL.

In order to secure accurate data on what has been done in the construction of brick pavements without sand cushions and to obtain opinions as to the value of that type of construction, "Good Roads" has addressed inquiries to a number of engineers who have had experience in such work, or who have given the matter consideration. The matter which follows, under the heading "Work Done and Comments on Methods Employed," has been prepared very largely from data furnished by the engineers addressed, and consists chiefly of descriptions of particular pieces of work. The matter following the heading, "Opinions of Various Engineers" consists entirely of statements furnished for "Good Roads," by those to whom inquiries were addressed.

Work Done and Comments on Methods Employed

Although the particular work primarily responsible for the present interest in the brick pavement without a sand cushion was performed last year, the method of construction can not properly be called new. Some paving experts have long believed the sand cushion to be unnecessary, if not actually harmful, and the available data indicate that brick pavements without sand cushions were put down in a few places, some years ago. For instance, in a paper presented at the 1915 convention of the American Society of Municipal Improvements, Will P. Blair, Secretary of the National Paving Brick Manufacturers' Association, stated that a brick street was built by the "monolithic" method in Cincinnati, Ohio, some twenty-five years ago, and that the brick gutters on Washington Street, Indianapolis, Ind., and some of the gutters on Ohio Street, Terre Haute, Ind., were built by the same method about eighteen years ago. He also mentioned an alley in Terre Haute which was paved with brick laid on the green concrete base and filled with cement grout. This pavement, according to Mr. Blair, had stood up satisfactorily for more than ten years, during which time it had been subjected to heavy traffic.

There are several later examples of brick pavement construction without the sand cushion, a few of which are noted.

In 1906 a portion of Lexington Street, in Baltimore, Md., was paved with brick, laid on a 1:3 mortar cushion, mixed moderately dry. The pavement, according to reports, has stood up well under traffic and no failures due to the method of construction have appeared.

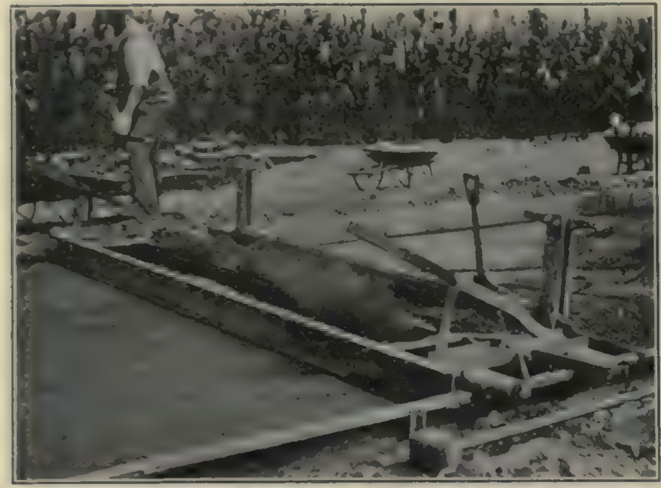
"MONOLITHIC" TYPE BRICK PAVEMENT BEFORE GROUTING—MIDDLE SPRINGFIELD ROAD, PARIS, ILL.

Another pavement that is often cited as an argument for the elimination of the sand cushion is that in a driveway at the Pennsylvania Terminal in New York City. The work was done in 1910, the brick being laid on a 1:3 cement mortar. Although the pavement carries heavy traffic and in some places has considerable grade, it is in good condition and is said to have required no repairs.

At the ice cream plant of the Telling Bros. Co. at Cleveland, Ohio, is a driveway paved with brick laid on a mortar bed. The work was done in 1914 and the pavement is reported to be in good condition. It carries heavy trucking.

In Springfield, Mo., according to City Engineer S. R. Fisher, there are about 4,000 sq. yds. of brick pavement, along street car tracks, in the construction of which the bricks were laid on a bed consisting of one part of cement and seven parts of sand. This is three years old and is very satisfactory.

During 1915, a considerable amount of brick paving was laid without the sand cushion, perhaps the most noteworthy work being that done at Paris, Ill. This work was done early last year, and was described in detail in a paper presented by Wm. C. Perkins, Chief Engineer of the Dunn Wire-Cut-Lug Brick Co., at the 1915 convention of the American Society of Municipal Improvements, held at



PREPARING BED FOR BRICK—SHOWING TEMPLATE USED FOR SPREADING SAND AND CEMENT MIXTURE.

Dayton. The following paragraphs are taken from the paper:

> The theoretical type of construction is that developed by Mr. W. T. Blackburn, of Paris, Ill., Consulting Engineer of the Dunn Wire-Cut-Lug Brick Co., who, assisted by Mr. Parrish, a local contractor, is laying the brick wearing surface direct on the freshly laid concrete foundation. This form of construction is attracting considerable attention from paving engineers and considerable mileage has been specified for roads in Indiana and Illinois, and has been thoroughly explained in the various engineering journals. Mr. Blackburn's specifications for road work in Edgar County, Illinois, using this form of construction are as follows:
>
> The foundation shall be four (4) inches in thickness with its upper surface finished to four (4) inches below the grade of finished pavement, and covered over with a thin coating of sand and cement, after they have been first mixed dry, to the depth of three-sixteenths (3/16) of one inch. In placing the concrete the operators shall be guided by a light wood template resting on side forms so made as to leave the concrete a little in excess of depth required. Over this shall be drawn a steel template consisting of a six (6) inch I-beam in front and six (6) inch channel iron to the rear, placed in a frame two (2) feet on centers, supported by two (2) rollers at either end resting on the steel forms; the first section, or I-beam, should be three-sixteenths (3/16) inch lower than the channel iron, and cut the concrete base practically to a true surface, four (4) inches below grade. In between these forms must be kept a sufficient amount of sand and cement thoroughly mixed dry. This rear template distributes this thin film of dry mortar over the surface of the base, leaving the surface entirely smooth. The template is one of the essentials of this type of pavement.
>
> Upon this foundation and bedding course the bricks are laid by the usual method and are rolled with a hand roller weighing not less than 20 lbs. per in. of length. The rolling should be kept close to the laying and continued until the surface is smooth. At the end of the working period the brick laying, inspection, and rolling must be completed with the limit of the finished base.

LAYING BRICK PAVING BLOCKS IN "MONOLITHIC" TYPE OF CONSTRUCTION—SHOWING BEDDING OF BRICKS.

> The advantages claimed in using the cement-sand bed or the new type of construction as developed by Mr. Blackburn are:
>
> Elimination of the hazard of the sand cushion, as the pavement will not be injured at any time by rain, the wearing surface, with the exception of the filler, being completed each day. If a rainstorm intervenes no damage is done, as there is no sand cushion to become saturated and cause worry about rolling the brick surface.
>
> Each brick in the wearing surface will be assured a cement bond its entire depth, for if the cement-sand should work up in the joints, it will set up and prevent the shearing action which tends to crush the top of the brick.
>
> There is no chance for the bed to shrink or shift away from the bottom of the brick wearing surface, as the brick is firmly bedded in the cement-sand or held in the mortar of the concrete base.
>
> Where these pavements have been laid there seems to be a total absence of any rumble under traffic.
>
> Slight settlements and breaking of bond due to non-uniformity of sand cushion are eliminated.
>
> In reference to the use of cement-sand bed mixed 1:5, the increase in cost over a 2-in. sand cushion will be from 5 to 6 cts. per sq. yd., but Mr. Compton states that in Baltimore there has been no appreciable increase in cost due to its use in that city.
>
> In county road work this type of construction eliminates the necessity of an edging, thus reducing the cost of the roadway.

In a paper presented by Rodney L. Bell, Division Engineer, Illinois State Highway Department, at the Northwestern Road Congress held at Cedar Rapids, Ia., in October of last year, the Paris work and similar work elsewhere in Edgar County were described in considerable detail. The advantages of the method were listed by him as follows:

APPLYING CEMENT GROUT TO FILL JOINTS IN BRICK PAVEMENT OF THE MONOLITHIC TYPE.

> (1) A better surface can be obtained.
>
> (2) The work is easier on both contractor and inspector.
>
> (3) There is no guesswork at any point of the construction.
>
> (4) Under similar conditions it represents a saving of from 10 to 12 cts. per sq. yd. over the old method.
>
> (5) Eliminates the breaking down of the filler at a construction crack, as each brick has a rigid support.
>
> (6) Opens the field for experiment with thinner brick.
>
> (7) The filler is sure to reach the bottom of the paving block.
>
> (8) Removes need of a flush curbing.
>
> (9) Eliminates the rumbling in brick pavements.

Experimental sections of brick pavement without sand cushion have been put down in Cleveland, Ohio, by the city in co-operation with the Case School of Applied Science. The following information relative to the work has been supplied by Maurice B. Greenough, Instructor in Highway Engineering at the Case School:

> Those streets of which you inquire which were laid in Cleveland without the sand cushion are of two kinds—those in which bricks were laid on a sand-cement cushion which was substituted for the standard sand cushion and a portion of an experimental street in which brick were laid upon the green concrete directly.

I take it that it is the latter method in which you are particularly interested at this time. Its construction was as follows:

Base, 6 ins. of 1:3:6 concrete, reinforced with triangular wire mesh, placed in the center of the concrete.

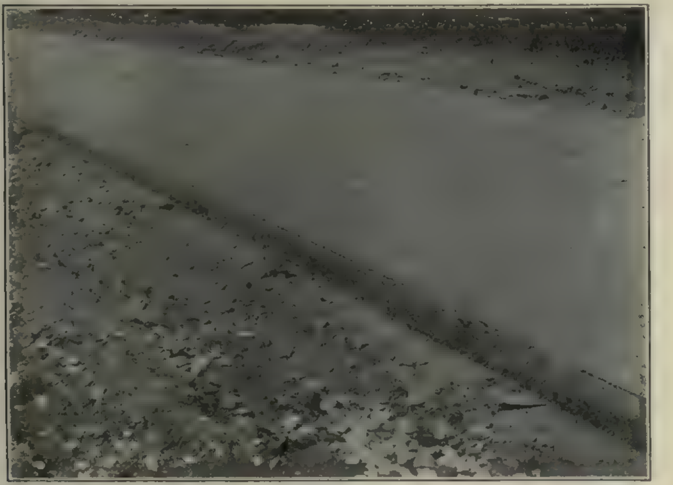
Concrete was mixed by machinery and placed in wheelbarrows on account of the short stretch which was under construction. It was smoothed off to grade and crowned with shovels. The best results with the surfacing were obtained by allowing the concrete to set for 30 to 45 minutes before placing the brick in position. After the brick (which were 5 ins.) were placed, they were brought to a smooth surface by means of a hand tamper weighing about 150 lbs.

You will notice in this construction that no templates were used to obtain an even surface. There was such a small amount, 60 ft., to be laid on the experimental street that it was not deemed worth while to go to the expense of building a template. Undoubtedly, better results are obtained by its use.

While it is rather soon to draw any conclusions regarding the effectiveness of this type of construction, all the indications, both from the practical and theoretical points of view, are in its favor.

On the East 65th St. experimental pavement the monolithic section abuts on a section constructed with a 6-in. concrete base and a 1½-in. sand cushion. The sand cushion section has already failed for a distance of 2 ft. from the intersection under 4 months of traffic. The monolithic section is still intact.

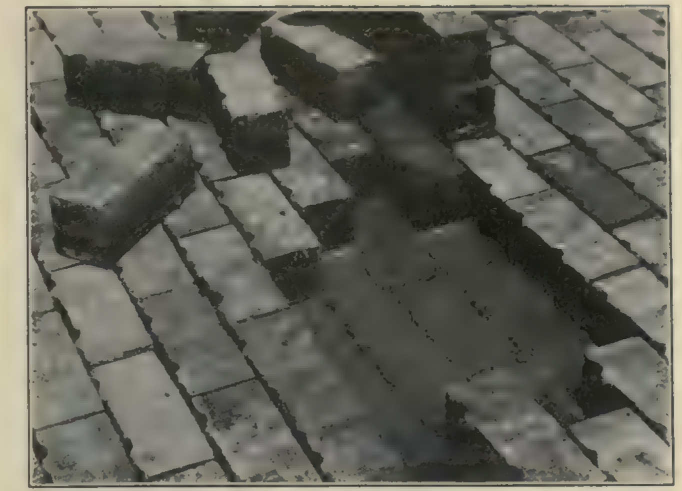
Considerable brick pavement with a cement-sand cushion was laid during 1915 in Cuyahoga County, Ohio, the total amount, according to County Engineer W. A. Stinchcomb, being 36,280 sq. yds. to the 1st of December. The increase in cost as compared with the plain sand cushion, according to Mr. Stinchcomb, has varied from 8 to 23 cts. per sq. yd., the average being 17.8 cts. for all the work done. He also stated that jobs under construction at the time of writing were being put in at an average advance of 14.2 cts. per sq. yd., while the average price bid for cement-sand cushion was 10 cts. per sq. yd. more than for plain sand, the apparent discrepancy being due to the fact that some of the work under contract was being done under supplementary agreements made after the contracts were let.



BRICK PAVEMENT OF "MONOLITHIC" TYPE—SHOWING COMPLETED PAVEMENT BEFORE BUILDING SHOULDERS.

According to City Engineer W. E. Sarver of Canton, Ohio, while no brick pavement without the sand cushion has been laid in the city there is, on the Massillon-Akron Road, several miles north of the city of Massillon, an experimental section of this type laid by Stark County. This is part of a road, several miles in length, paved with brick. The experimental section is paved to a width of 16 ft. 4 ins., the foundation being of concrete, 4 ins. in thickness. On this section the curbs, which on the remainder of the road were built with the foundation, were omitted.

The concrete foundation was placed 20 to 30 ft. in advance of the brick laying and finished by means of a tamping template. This template was drawn back and forth upon wooden forms placed at the sides of the road, at the same time being raised and lowered from ¼ to ½ in. This produced a smooth and uniform surface. The bricks were laid directly upon this foundation and rolled with a hand roller, longitudinally, transversely and at an angle, until a very smooth surface was obtained. An inspection of the pavement a few minutes after laying, according to Mr. Sarver, showed that the mortar had been brought to the surface of the concrete and had extended up into the joints from ½ to ¾ in. Such low spots as developed, evidently from the sinking of the brick into spots where the mixture was too wet, were corrected by lifting out the brick, spreading upon the concrete a dry mortar composed of one part cement to one part of grouting sand, replacing the brick and rolling it as before. The rerolling of the brick in such spots produced the same result in flushing the mortar to the surface and up into the joints as was noticed on the rest of the pavement. The joints were grouted with a 1:1 mortar, the grouting being carried on simultaneously with the other work so that at the end of a day's work the pavement had been completed from the subgrade to the earth covering.

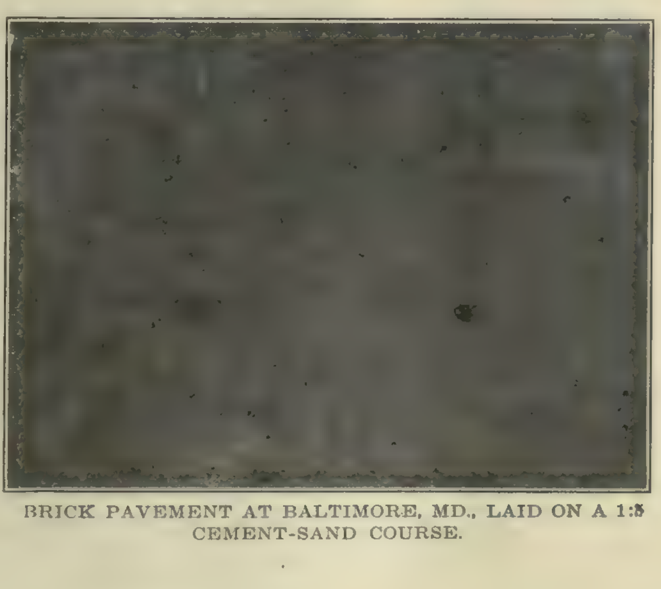


BRICK PAVEMENT OF "MONOLITHIC" TYPE—SHOWING BRICKS REMOVED AFTER ROLLING.

A statement of Mr. Sarver's opinion of this type of construction is printed on a subsequent page.

Opinions of Various Engineers

In the following pages are extracts from letters received from various engineers in reply to the requests for statements to which previous reference has been made. The engineers quoted are all men who have had experience in the type of construction under discussion, or who have observed such work and the results obtained.



BRICK PAVEMENT AT BALTIMORE, MD., LAID ON A 1:5 CEMENT-SAND COURSE.

It should be noted that the first of the following statements is from a paper presented by Mr. Tillson at the recent road congress at Worcester, Mass. The paper, which was entitled, "City Pavements," dealt with the methods of constructing various pavements, and the discussion printed here was taken from that portion of the paper dealing with stone pavements. Under the heading "Brick Pavements," however, Mr. Tillson called attention to this discussion and stated that he felt that the conclusions regarding stone pavements would hold good for brick pavements and that he believed better results would be obtained with the sand cushion than with the mortar bed.

GEORGE W. TILLSON

Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.

Practically all stone blocks laid up to the present time have been laid on a sand cushion. There is, however, at the present time a discussion going on to a certain extent in the technical press and among engineers as to the advisability of using a mortar bed for stone blocks. If this be done, the whole pavement, including the foundation, will be practically one piece of masonry construction and extremely solid, so solid in fact that the wear under traffic will be more than if it were resilient. If the pavement itself has a cement filler, and so becomes a monolith, this objection is not so great, but the more solid a stone pavement is the more noisy will it be and the greater its wear.

If a cheap cushion could be made of some resilient material, say a combination of certain bitumens with sand or stone, the writer thinks it would be much more satisfactory than a mortar bed. As has been said, the greatest objection to a granite pavement is its noisiness, and if each individual block can be segregated so that a resilient substance will separate it from every other block or the foundation itself, a pavement the least noisy of all can be obtained. If, for instance, stone blocks could rest on an India rubber cushion, with the spaces between the blocks filled with India rubber, the pavement would be resilient, as quiet as possible, and, on account of its resiliency, show the least wear under traffic. While it is undoubtedly impossible to obtain such a condition, it can be approached by filling the joints and the spaces under the blocks with some bituminous material that will have as many as possible of the qualities of India rubber.

W. A. STINCHCOMB

County Engineer, Cuyahoga County, Ohio.

Our experience so far seems to indicate that the cement-sand cushion is going to solve many of the difficulties with brick pavements due to the longtitudinal cracks and to the breaking of bond and the settling of the brick, and fracturing of the brick due to the bond breaking. We do find the following defect more common than under the old plan of merely sand cushion, which was to be expected; namely, that the pavement shows a more decided tendency to transverse cracks, which occur on a 16-ft. country road about from 50 to 75 ft. I anticipate no particular difficulty by reason of that trouble, but believe the same will have to be handled the same as cracks would be on concrete roads, by filling the joints with a combination of sand and some form of bituminous material.

I believe that the cement-sand cushion or some method of constructing the pavement by which the wearing surface is laid immediately on the base is advisable. In my opinion it strengthens the construction in two ways, in that it has a tendency to avoid longitudinal cracking and breaking of the bond due to the settlement of the block into the sand cushion, or to the saturation of such cushion, but that it also increases the strength of the pavement as a whole by making the same a monolithic structure, so that when considered as a slab supporting a load, its strength is increased by reason of the increased effective depth of the structure.

Our present cross section provides for a section flat on the bottom with a combination curb and base constructed as a monolith, the width of the curb being 8 ins., and the crown made in the top of the base, so that we have a pavement about 2 ins. thicker in the center than at the side, which I believe is right and proper, for at that point the greatest bending stresses must occur. With that type of construction, using the curb, I can see no ready means of laying the pavement directly on the base, and I am not absolutely sure at present whether the type of pavement now being laid at Paris, Ill., where no curb is used and where the thickness of the pavement is reduced by the amount of cushion formerly used, would be cheaper than the type we are using or not, when you consider the fact that our curbing is much cheaper than an equivalent area of brick pavement and yet is effective and answers as a paved surface, while the cushion we use acts as that much additional base under the pavement.

I might add that on the repairs which are now being made on our roads we are laying the brick directly upon the green concrete. While this practice has been followed only a portion of this season, the results so far, while increasing slightly the cost, in my opinion, justify the act.

WM. H. CONNELL

Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pa.

I really would not care at the present time to enter into the discussion relative to the practice of constructing brick pavements without a sand cushion, as I do not think that the studies that have been carried on in this connection are sufficiently developed to make any very definite statement. I do believe, however, that the sand cushion should be reduced to 1 in. and I am now using a 1-in. sand cushion.

W. T. BLACKBURN

Consulting Engineer, Dunn Wire-Cutting-Lug Brick Co.

I am of the opinion that the sand cushion has been of no other value than a convenience in the construction of a brick pavement and that the use of the dry mortar cushion, or the construction of the brick pavement where the bricks are laid directly on the green mortar and rolled with a light roller, will prove to be far more satisfactory and eliminate the possibility of the sand being forced up between the brick, reducing the depth of the cement filler, and will give a support at all times to the individual unit and result in a pavement more durable and economical to construct. As far as I can learn, pavements built in this manner have proven satisfactory.

We have something over two miles of brick pavement where the bricks were laid directly on the green mortar, constructed this year in the vicinity of Paris, Ill. The type of construction has been followed in several communities, and thus far the methods adopted have proven very satisfactory. I think it only remains for the engineer to provide specifications that will meet all of the different conditions that may arise.

W. W. MARR

Chief State Highway Engineer of Illinois.

We have done quite a good deal of this work and are very much impressed with the many desirable features we have noted. Personally, I think it is an ideal method of building brick rural highways, and now we are reducing the cost of such construction by reducing the thickness of the concrete base and by using lighter types of brick.

All of our experiments so far have been successful, as far as we have been able to judge in the time since the construction was done.

I think a great deal of money is wasted in concrete foundations for brick pavements on rural highways. When we stop to consider that a dry earth road sustains any load we place upon it without showing any appreciable depression, it seems apparent that ordinary earth in proper condition will fully sustain our traffic. If then, we lay sufficient sand and cement, say 1 in. thick, mixed about 1 to 3, over a properly graded road as a cushion or base which operates mainly to prevent earth from rolling up into the joints of the brick during construction, and then fill the joints perfectly with a grout filler, I see no reason why the type will not meet all of the requirements of ordinarily heavy traveled country highways and at a considerably less cost than the types now adopted. We have made some experiments along this line and have great hopes for their success.

W. W. CROSBY

Consulting Engineer, Baltimore, Md.

Sand cushions have been used between the foundation and the wearing course of vitrified brick as well as other block pavements, for two reasons. The first is because the layer of sand affords a cheap and easy way of compensating for any deficiencies in evenness of the surface of the foundation and for variations in the depth of the brick. The second reason is the belief that this layer of sand, interposed between the firm foundation and the hard, rigid wearing course, gives a certain amount of resiliency to the latter under traffic, and decreases to some extent the resonance of the completed pavement.

The difficulties in the use of the sand cushion have been those of securing an even layer of sand, uniform in composition, compaction, and thickness, and those of preserving it in place in this condition. These difficulties have not been inconsiderable, and have warranted great care and much thought being given to the selection of the sand and to its placing. Even then, it has been found necessary to take precautions against subsequent displacement of the cushion through causes frequently present.

Attempts have been made along various lines to accomplish the desired results and to overcome the objections to plain sand cushions by the substitution of other layers or cushions, such, for instance, as a mixture of sand and pitch, and suggestions have been made for a mixture of pitch and sawdust, which might in some cases be advantageous. None of these attempts or suggestions have been experimented with long enough as yet to warrant conclusions from them.

The most recent suggestion is the substitution for the plain sand of a lean mixture of Portland cement and sand, it being held that little or no increase in cost would result, and that the cement would effectively prevent any displacement of the sand particles. To do this, it must necessarily either fill the voids in the sand particles, so as to bring about the condition of inherent stability in the layer and thus prevent its displacement except where the flow into an opening is possible, or the cement must act as in the case of mortar or concrete which has become set. Undoubtedly it must do one or the other, but in either case, it would seem as though an inevitable decrease or the elimination of all resilency in the sand layer must follow. With any such decrease or elimination, it would seem that the rigidity of the brick pavement and its resonance must similarly increase. Where motor traffic on rubber tires is alone to be considered, the result should not be objectionable, but where animal-drawn traffic and hard tires are to be used, it would seem as though any increase in the rigidity or resonance of brick pavements would seriously interfere with their selection for use under such traffic.

A sand cushion properly provided and preserved in place affords an entirely satisfactory bed for the brick in the wearing course and seems to permit the development of the highest possible results from the use of brick. A more rigid support to the brick may increase its liability to fracture under shock. On the other hand, the liability of the plain sand cushion to become displaced during the operations of construction or thereafter may result in uneven support to the brick and thus afford, when so displaced, an excellent opportunity for the unevenly supported brick to become broken under the strains coming on them.

The writer believes that the experience with mortar cushions in brick pavements is yet too brief to warrant definite conclusions being expressed at this time. He believes that the experiments along this line are for the present well worth while, but he is more inclined to the replacement of the plain sand cushions with a more resilient cushion, such as a mixture of sand and pitch, of wood fiber and pitch, or of sawdust and pitch, than to the substitution of a rigid layer of sand and cement.

D. MOOMAW

Road Engineer of Cuyahoga County, Ohio

Our first pavement of this type was started in the spring of 1915.

We shall endeavor to eliminate entirely the plain sand cushion from our pavement construction in the future.

In our repair work which is done by direct labor, we are putting in the purely monolithic construction similar to that used in Paris, Ill. On this work, however, we do not spread the dry mixture of cement and sand upon the fresh concrete, but depend upon getting enough fresh mortar on the top to form a bond with the brick.

NELSON P. LEWIS

Chief Engineer, Board of Estimate and Apportionment, New York, N. Y.

I believe that the sand cushion usually used under brick pavements is thicker than necessary and can advantageously be reduced, the thickness required being dependent upon the uniformity in depth of the brick and smoothness of the concrete foundation, in which there will always be some irregularity. I believe that there is need of a cushion of some sort under brick pavements, as the material is too rigid and non-resilient to be placed directly on a concrete base. I think that the sand cushion could in the case of brick of uniform depth and a smooth concrete base be reduced to three-quarters of an inch, and I further believe that if the surface of the concrete foundation can be made more uniform than is the common practice, a bituminous cushion could advantageously be substituted for the sand, the thickness of this cushion being perhaps not more than one-quarter of an inch. I do not believe that it would be wise to dispense with the cushion altogether as has sometimes been suggested, or that it would be wise to bed the brick in cement mortar. The resulting pavement would be entirely lacking in resiliency, and, while it might be adapted to automobile traffic, it would be very unfavorable to horse-drawn traffic.

I do not feel justified at the present time in expressing any more definite opinion on this subject.

H. W. DURHAM

Consulting Engineer, New York, N. Y.

The writer has had considerable experience in the construction of brick pavements where a sand cushion was employed. On no occasion has there come to his attention any case of failure or defect in a brick pavement arising from the displacement of a sand cushion, subsequent to the completion of construction. If a concrete foundation is used under the sand cushion, and the pavement is laid between solid curbs, it is difficult to conceive of any way in which failure could result from movement in the sand cushion, unless it was caused by some subsidence of the foundation, which would injure the wearing surface no matter what method was employed for bedding it.

The proposed alternative to be used when sand cushion is omitted is generally referred to as a mortar bed. Hardly ever, however, is any statement made as to what is meant by this term. Two possible methods can be employed. In one case, the mortar bed is merely a sand cushion to which has been added a certain proportion, usually 1 to 1, or 1 to 2 of Portland cement, and the mixture spread virtually dry or only slighly dampened previously to laying the brick. The writer has employed this method in the laying of asphalt block and wood block pavements, and, of course, it can be used in the same way with brick. The difference, however, would be that each of the two former types of wearing surface possesses some inherent elasticity, which is not the case with brick.

The so-called mortar bed eventually sets to a consistency somewhat resembling plaster, and while it is rigid does not, of course, possess the strength of the concrete to which it forms a surface. An alternative to this would be the use of a wet mortar surface plastered on the concrete foundation before it had taken its final set. The writer is not familiar with any case where this latter method has been employed in this country. It is used in Europe to get a smooth concrete surface on which to lay wood block.

If it should be used with brick there is no question but that it would result in a monolithic type of pavement construction, and would present some ground for the advocates of monolithic concrete road surface to inquire why the brick wearing surface should not be omitted altogether. It is the writer's belief, based on observation and the construction of brick, asphalt block, wood block and granite block pavement, that where the block which is to form the wearing surface is in itself rigid, it will be more satisfactorily laid on a thin cushion of sand spread on a concrete foundation, and that the addition of cement to this sand, will offer no return of any value commensurate with the additional cost.

ROBERT HOFFMAN

Commissioner and Chief Engineer of the Department of Public Service, Cleveland, Ohio

We have laid several stretches of pavement this year, using as a cushion a mixture of 1 part cement to 4 parts sand.

This work has been experimental, in order to determine, if possible, what virture there is in this kind of construction. So far no objections have arisen.

In my judgment, the addition of cement to the sand cushion certainly cannot be detrimental, so that we may look for an improvement in the construction of brick pavements by the use of this kind of a cushion.

After our pavements have passed through a winter season, we may be better able to draw conclusions in reference to the matter herein mentioned.

RODNEY L. BELL

Division Engineer, Illinois State Highway Department

At the present time this work (Edgar Co., Ill.,) is showing up nicely. We have been keeping close tab on the exposed ends of this work and so far there has been no sign of any cleavage between the concrete base and the brick wearing surface

As to my personal opinion of this type of work, I feel that, while we may find things that will need to be corrected, we have come nearer to finding the ideal brick pavement in this than in any other type of construction which has ever been attempted.

We have had a number of visitors to our work here at Paris this summer and, after seeing how this work was constructed, they have all practically agreed that, insofar as they could tell at this time, this is the ideal way to build a brick pavement.

R. KEITH COMPTON

Chairman and Consulting Engineer of the Paving Commission, Baltimore, Md.

The first work of this character in Baltimore was done in 1906. Only one street was done at that time, as we then followed the standard specifications used all over the country calling for a sand cushion, and this sand cushion was kept in use until I made one or two experiments in 1914. This year (1915) all of our work has been on a cement-sand cushion mixed 1 of cement to 5 of sand.

With the street before me still in good condition laid in 1906, the experiments which I made last year, and with the 1915 work before me, some of which has been under traffic, and very heavy traffic at that, since March 1st, and with absolutely no failures in the grouting, I am convinced that the cement-sand cushion is the proper thing.

G. L. SICKAFOOSE

County Surveyor, Stark County, Ohio

I have examined some brick roads constructed without a sand cushion.

I have been building brick roads for about fifteen years, and I see no reason for using a sand cushion as I am led to believe the sand only adds an element of weakness. I have thought well enough of this kind of construction to put in over 400 ft. this season of a sample pavement, and I will watch it closely for developments.

W. E. SARVER

City Engineer of Canton, Ohio.

The writer was very much impressed with the possibilities of this type of construction and believes that this or some similar type is the proper one for cement grouted pavements, both on account of the elimination of the variable and unsatisfactory sand bed and the less cost. Taking into account excavation, the elimination of the cost and expense of the sand bed, and especially upon county road, the elimination of curbs, the cost of this type of pavement should be reduced by from 8 to 10 cents per sq. yd. This department intends to construct at least one street this coming season, part of which will be of this type and part of the "Paris" type—dry mortar bed.

It has been the opinion of the writer, for several years, that the term "sand cushion" is a misnomer and that a sand cushion is undesirable and a grave mistake. The only real function of the sand is as a bed; it is required only for producing a smooth surface in the wearing surface of the pavement. With this in view, we have reduced the sand bed from 2 ins. to 1 in. in thickness, and required a more uniform thickness, obtained by more care in the surface of the concrete base. We have also required a loamy sand, kept moist while being compacted, so as to produce a firm bed instead of a cushion. The results have been so satisfactory that we have reached the conclusion that the less sand the better. Then why not omit the sand entirely and remove one of the obvious errors in the supposition that two rigid bodies will work in perfect harmony when an uneven, un-uniform and shifting material lies between them?

A study of the condition of cement grouted streets constructed two and three years ago revealed the fact that only three out of some twenty-five or thirty streets have longitudinal cracks that are at all noticeable. One of these was constructed upon springy ground, that was practically impassable except in the summer months, underdrains placed below the curb lines and on the property side of the sidewalks being put in where the condition of the earth made it seem necessary. Where these drains were placed the pavement is perfect, but at several other places which, it developed later, should have been similarily under-drained, the pavement has not cracked. On the other two streets where the cracks developed early in the spring of the second year, it has developed that they were constructed in an old huckleberry swamp and consequently were not properly drained. An investigation was made on the last named streets by taking up the pavement, to determine the cause of the cracking, being of the opinion that the trouble was drainage and frost. While we fully expected to find the concrete base also cracked we were unable to find such to be the case. We did find the concrete base wet and the sand cushion, 1½ ins. thick in these cases, also very wet, apparently sufficiently wet to expand enough to fracture the pavement when frozen.

Our experience seems to show that we practically eliminated one of the main causes of the longitudinal cracking of the pavement when we constructed sand bed instead of sand cushion; and upon clay soil we are endeavoring to eliminate another by the proper drainage of the subsoil.

The failures of the older grouted brick streets were found to be caused by two things, namely the use of sand cushion, the sand protruding up into the joints while being rolled, and the failure to place grout uniformly in the total depth of the brick, caused by the sand in the joints and carelessness in placing the grout.

Highway Work in Kentucky

It is probably not generally known that although Kentucky has only recently commenced the conduct of highway improvement work by state aid, it was one of the first states in which the central government took an active part in road building. It is a fact, however, that prior to 1840 the commonwealth had expended over $2,000,000 for the construction of macadam roads.

Over a century ago, the Kentucky General Assembly made provision for the opening of roads to the Virginia line, and in 1820 the building of macadamized roads was commenced. During the period of activity prior to 1850 and the discontinuance of internal improvement work because of financial and political conditions, road work was under the supervision of a state engineering department in which were included a state highway engineer at a salary of $5,000 a year and a corps of assistants who were paid annual salaries ranging from $1,100 to $2,500. The roads built were well located on 60-ft. rights of way and were graded to widths varying from 24 to 30 ft. between ditches. Telford foundations and macadam surfaces were put down and many of the roadbeds are still in service and in good condition.

A STATE AID ROAD IN LEWIS COUNTY, KENTUCKY—6-IN. BROKEN SANDSTONE BASE WITH 4-IN LIMESTONE WATER BOUND MACADAM SURFACE

A SHORT SPAN REINFORCED CONCRETE BRIDGE, WITH CONCRETE GUARD RAILS, ON A STATE AID ROAD IN LEWIS COUNTY, KENTUCKY

After the end of this early work there was no attempt to put the state aid principle into practice until 1908. In that year the General Assembly made laws providing for constitutional amendment permitting the state to lend its credit to the counties for the construction of roads. The amendment was ratified by the voters during the following year and in 1910 several bills designed to make the amendment operative were introduced in the General Assembly. In 1912 a law was passed establishing the Department of Public Roads.

This law provided that the chief officer of this division of the state government should be the Commissioner of Public Roads and that he should be appointed by the Governor on or before July 1, 1912, and every four years thereafter. The appointment of the necessary staff was vested in the Commissioner of Public Roads, with the approval of the Governor. The functions of the department were to be purely advisory. The cost of the department's maintenance was provided for by the creation of a state fund derived from the license tax on motor vehicles.

In accordance with this law, Governor McCreary appointed Robert C. Terrell, at that time Professor of Rural and Highway Engineering at the University of Kentucky, as the first Commissioner of Public Roads. Commissioner Terrell entered upon the duties of his office on July 1, 1912. From that time until Jan. 1, 1915, when there became operative a law giving the department broader powers and providing for the use of state money in road work, the organization of the Department of Public Roads was completed and a large amount of work was done by the department in preparing plans and advising with local officials. During 1912 approximately $1,800,000 was expended by the counties for road work. The county expenditures in 1913 were about the same, and in 1914 they reached a total of about $2,000,000.

In 1914 the General Assembly enacted laws creating a system of state highways and providing for money aid to the counties. The state highway system, according to the law, comprises "roads connecting the county seat of each county of the commonwealth with the county seats of the adjoining counties by the most direct and practical route, and the county seats of the border counties of the commonwealth with the state line on the most direct and practical route leading from said county seats to the county seats of the adjoining counties in the adjacent states." It was further provided that these roads should be the first to receive state aid. Another law provided that the Commissioner of Public Roads should have general supervision over all roads constructed, improved or maintained, either wholly or in part, with state funds. Money for extending state aid to the counties was provided for by a law levying a road tax of 5 cts. on each $100 of taxable property in the state. The funds secured by this tax and those accruing from motor vehicle fees are apportioned to the counties, any county being allowed an amount equal to half of the total expenditure of that county for work done under the direction of the Commissioner of Public Roads, provided that in any one year no county may receive more than 2 per cent. of the total amount collected for the state road fund in that year. The counties finance the work, the state's share being paid upon completion of the improvement.

These laws became effective Jan. 1, 1915, and the counties were asked to file their applications for state aid. Of the 120 counties in the state 104 made application, but as 14 failed to have the necessary plans prepared, state aid work is under way in only 90. In these there are being built 800 miles of highways varying from earth roads to roads paved with cement concrete, bituminous surfaces and brick. The surfaced widths vary from 9 ft. for single track roads graded to a width of 20 ft. between ditches to 18 ft. on roadbeds 24 ft. wide between ditches.

On July 1, 1915, there was in the treasury an unexpended balance of over $210,000 obtained from motor vehicle license fees. With the income from the 5-ct. tax, this brought the total of the state road fund for 1915 up to $747,519. In addition to this amount to be paid by the state, the counties pay an equal amount and, in many instances, will expend still more. In fourteen counties, additional expenditures from the proceeds of bond issues have been made during the past season. The counties which have issued bonds, with the amount in each case, are as follows:

Ballard, $300,000; Bell, $250,000; Breathitt, $150,000; Carroll, $50,000; Clinton, $50,000; Fayette, $300,000; Greenup, $200,000; Knox, $200,000; Laurel, $100,000; Lewis, $150,000; Nicholas, $125,000; Rockcastle, $100,000; Russell, $40,000; Whitley, $250,000; total, $2,265,000.

State Commissioner of Public Roads Terrell states that while 75 per cent. of the counties are taking advantage of state aid it is certain that the courts of counties which have not previously applied for state aid will take advantage of the law this year and that the work will go forward with much more ease and rapidity than during last year. While the results obtained during the year 1915, according to Commissioner Terrell, were eminently satisfactory both to the state and county officials, there is no doubt that results in 1916 will be far better than those obtained in 1915.

The principal officials of the Kentucky Department of Public Roads is as follows: Commissioner of Public Roads, Robert C. Terrell; Bridge Engineer, R. Wiley; Division Engineers, T. B. Webber, J. F. Grimes and M. D. Ross; Assistant Engineers, W. T. McDyer and W. A. Obenchain; Chief Clerk, J. M. Kendall.

The Road Official and His Constituents

Somewhat caustic but doubtless justifiable comments on the relations between the road official and his constituents were made in a paper entitled "Attitude of County Commissioners Toward the Public," read at the sixteenth annual convention of the Washington State Good Roads Association last fall by W. H. Reed, of the Pierce County Board of Commissioners, who is also President of the Washington State Association of County Commissioners. Commissioner Reed's observations—for printing all of which space is, unfortunately, not available—will probably meet with the ready indorsement of more than a few harassed highway officials.

With the decay of feudalism, according to Mr. Reed, the people embraced the ideas of those economists whose teachings are that the individual is the unit in government instead of the people as a social group. The avowed purpose of these economists was to make it impossible for the democracy as a unit to interfere with the desires of any person within the democracy. Regarding this, Commissioner Reed said:

"This political tenet runs directly counter to the common weal, the public welfare doctrine for government. It's the deification of the spirit of selfishness—the 'I come first' idea.

"The county commissioner learns with experience that this selfish purpose is substantially the universal one. Hence his attitude toward the people becomes one of wariness. And, if he has plenty of backbone, and aims to fulfill his duty as a public officer, he fights this spirit of selfishness, without being swerved by friendship, party threats or votes—in the interest of the common good, the people as a whole; and he thereby cuts his own throat, for the people not immediately affected care not, while the man or men, unsuccessful in attaining his or their selfish ends, don't forget."

Commissioner Reed said that farmers not living on hard surfaced roads complained that the commissioners were spending all the money for automobile roads, and he also said that a grange had passed resolutions condemning the board for building hard surfaced roads, claiming that the money should be used to build more earth roads as the hard surfaced roads hurt the horses' feet. In commenting upon this, Commissioner Reed said:

"Doesn't it strike you as astonishing—I was going to say astounding—that a body of farmers could deliberately pass such a resolution in the face of these obvious facts:

"First: The permanent highway money pays for most of our hard surfacing; and this money can be expended only on trunk roadways.

"Second: The chief beneficiary of hard surfacing, for several obvious reasons, is the farmer, though he may live on dirt road laterals which lead to the trunk roads.

"Third: It is noticeable that where there are good dirt or graveled roads adjoining any part of the paved portion of the roads, they seldom show wheel tracks, which should be there if the humanely perturbed farmer believed the pavement 'hurt his horses' feet.'"

Many examples of the selfish attitude as contrasted with the right attitude toward public work were cited by Commissioner Reed. In one case that he described, the farmers in a certain locality, who had had an undue amount of road building done for them, voted against the commissioner who had so favored them because, as they reasoned, they had got so much from that commissioner already that their chances for more roads would be better with a new officer.

The newspapers were severely criticised by Commissioner Reed, who expressed the conviction that they generally play politics and seldom care for the good of the people as a whole. As an example of this, he cited the attitude of the press in connection with a contract on which sand was supplied to the contractor from the county bunkers. The facts, as recited by Commissioner Reed, were as follows:

The county owned some land favorably located for the installation of sand and gravel bunkers and, accordingly, these were installed, with the result that sand, gravel and crushed rock could be obtained at an average cost of 33 cts. per ton, including interest on the investment and depreciation on the plant. The previous prices for these materials had been from 50 to 55 cts. per ton for sand, 60 cts. for gravel and $1.00 for crushed rock at the plant. In advertising for bids for the construction of a hard surfaced road, the county offered the bidders sand at 30 cts. per ton, on cars at the bunkers. Bidders, consequently, based their estimates on sand at 30 cts. and bid accordingly. It afterwards developed that the county couldn't furnish sufficient sand from its own bunkers and, therefore, had to buy sand at from 50 to 55 cts. and sell it to the contractor for 30 cts.

It was explained by Commissioner Reed that the county sustained no loss by this transaction as the bidders had bid lower than they would had not the county arranged to supply sand; and the shortage of sand was more than offset by the increased yield in gravel. The facts were known to the press, yet for purely party purposes some of the newspapers "derided and decried" the county commissioners for buying sand at from 50 to 55 cts. and selling it at 30 cts.

The Highway System of Pennsylvania

Pennsylvania's area and location, its diversified topography, its large rivers, the number of populous cities included within its borders and its great commerce and industries combine to make highway work in that state of particular interest. In order to appreciate the character and the magnitude of the road work now being done by the state, a brief survey of the factors enumerated is necessary.

Charles II of England granted Pennsylvania to William Penn in payment of a debt of £16,000. As described in the original charter, the province extended westward from the Delaware River five degrees of longitude and was bounded on the north by "the beginning of the three and fortieth parallel of northern latitude" and on the south by "the beginning of the fortieth degree of northern latitude." The present state has a land area of approximately 44,000 sq. miles, about one-fourth of which is covered by the hills and mountains of the Appalachian system. The Allegheny Mountains extend nearly across the state in a general northeasterly direction, dividing it roughly into two parts. There are many large rivers within the state. Among them, in the eastern portion, are the Schuylkill and the Lehigh, which are the two principal branches of the Delaware River—the eastern boundary of the state—and the Susquehanna, with its various tributaries, of which the Juniata is the largest. In western Pennsylvania are the Monongahela and the Allegheny, which unite to form the Ohio; the Youghiogheny; the Big Beaver, and the Kiskimmitas. There are about 97,850 miles of road in the state. Of these 10,200 miles are now classed as state highways.

The state was first settled largely by Quakers, and until about 1700 most of the settlers were English, Welsh and Irish. In 1690 the population was 12,000 and by 1790 this had increased to about 434,000, the state then ranking second in number of inhabitants. From early in the eighteenth century until the outbreak of the Revolution, the settlement of the state was largely by Germans. The population had passed the million mark by 1820 and in 1910, according to the census of that year, had reached the total of 7,665,111, making Pennsylvania the second largest state in the country in point of population.

The movement of population westward created a demand for roads, and the state was the scene of some of the most famous events in the early history of road building in this country. Between 1792 and 1794 the Lancaster Turnpike, the first stone turnpike built in America, was constructed between Philadelphia and Lancaster. It was built by a private company, and it was the first of the privately owned roads that later became so common not only in Pennsylvania but in other states. It formed the eastern section of the historic Forbes Road, which connected Philadelphia and Pittsburgh, passing through Lancaster, Carlisle, Shippensburg, Bedford, Ligonier and Greensburg. The Forbes Road was an important channel of communication between the East and the territory considered as the West during the early days of the country and was known by different names in various parts of the state. The Old National Road was another of the Pennsylvania highways built between 1800 and 1830. Until the middle of the nineteenth century, these roads were very important factors in the inland commerce of the state, but the construction of canals, which commenced about 1830, and the coming of the railroads diverted traffic from Pennsylvania highways as it did from those in other parts of the country.

THE OLD NATIONAL ROAD IN PENNSYLVANIA AS RECONSTRUCTED BY THE STATE HIGHWAY DEPARTMENT—BITUMINOUS WEARING SURFACE.

Records of road building during the years intervening between the era of the turnpikes and the establishment of the State Highway Department are not readily available. the work during that time being administered by local officials. In 1895, however, a law was passed authorizing the county commissioners to provide for the systematic improvement of township roads, issuing bonds to pay for the work. This law was enacted because of an insistent demand for better roads, and it resulted in considerable progress in some parts of the state.

The first provisions for state participation in road building in Pennsylvania were made by an act of the General Assembly which was approved in April, 1903. At the next session of the Legislature this law was amended and was approved in May, 1905. A State Highway Department, in charge of a State Highway Commissioner and an Assistant State Highway Commissioner, was provided for by the law of 1903, and in accordance therewith Joseph W. Hunter was appointed to the former office, which he held until June 1, 1911. The Assistant State Highway Commissioner was George Statler. The amended law of 1905 repealed the provision for an assistant state highway commissioner and although a corresponding office was designated no appointment was made until 1909 when [illegible] was made Assistant State Highway Commissioner. In July of the following year, Mr. [illegible] was made Deputy State Highway Commissioner and [illegible] Assistant State Highway Commissioner. Messrs. [illegible] and [illegible] served until the enactment of the 1911 law.

Under the law of 1905 the initiative for the construction of a township road lay with the board of supervisors of a township. This board could apply either to the county commissioners or to the State Highway Department. If the former course were adopted and the county board joined with the township board in petitioning for the improvement, 12½ per cent of the cost of the work was paid by the county, 12½ per cent. by the township and the remaining 75 per cent by the state. If application were made direct to the state, the township paid 25 per cent of the cost and the state 75 per cent. The State Highway Department made all surveys and plans and the State Highway Commissioner awarded the contracts. Besides the 75 per cent. of the cost of construction, the state paid all of the cost of administration and a portion, not exceeding 75 per cent., of the cost of maintenance.

Work done under these laws included the reconstruction of about 850 miles of road at a total cost of about $[illegible]. This included the cost of grading, draining, constructing the foundation and wearing surface, building bridges, engineering and inspection, and the payment of damages. The engineering amounted to about [illegible] per cent of the total cost and inspection to about [illegible] per cent. In addition to the cost of maintenance of roads built by state aid, the state contributed a part of the cost of maintaining something over 2,000 miles of road which had been reconstructed by the counties and towns without state aid.

The total amount appropriated for reconstruction work between June 1, 1905, and May 31, 1911, was $[illegible]. Of this total 90 per cent was apportioned to the several counties, except Philadelphia County, which corresponds to the city of Philadelphia, in proportion to the [illegible] miles of township road in each. The 10 per cent remaining was set aside as a maintenance fund for distribution among the townships and counties having improved roads in proportion to the number of miles of such roads in each. Under the law of

FOUR VIEWS OF PENNSYLVANIA ROADS MAINTAINED BY THE STATE HIGHWAY DEPARTMENT—SURFACE TREATED WITH ASPHALTIC OIL AND STONE CHIPS

1905, as amended in 1909, oversight of approximately 88,000 miles of unimproved roads was given to the state to the extent that township officials were obliged to make annual reports to the State Highway Department. From these reports there were made the apportionments of the appropriation to townships of the second class maintaining the cash road tax system. Each township maintaining this system was entitled to an annual allotment equal to 50 per cent of the amount of the road tax collected in the township, provided, however, that no one township should receive over $20 annually for each mile of township road.

ROBERT J. CUNNINGHAM,
State Highway Commissioner.

GOVERNOR MARTIN G. BRUMBAUGH,

JOSEPH W. HUNTER,
First Deputy State Highway Commissioner.

GEORGE H. BILES,
Second Deputy State Highway Commissioner.

WILLIAM D. UHLER,
Chief Engineer.

The Governor and Principal Highway Officials of Pennsylvania

In 1911 the General Assembly enacted a measure known as the Sproul bill, which, with subsequent legislation amending and supplementing it, is the present highway law of the state. An abstract of the Sproul bill was published in "Good Roads" for August 5, 1911.

The original bill provided that the Governor should appoint a State Highway Commissioner at a salary of $8,000 a year; a First Deputy State Highway Commissioner at $6,000; a Second Deputy State Highway Commissioner at $6,000; a Chief Engineer at $7,000, and an Auditor at $3,000. It also provided for the appointment by the State Highway Commissioner of the following: An Engineer of Bridges at $3,600, fifty superintendents of highways at $1,500 each, a Chief Draftsman at $2,400, and a Chief Clerk at $2,400. The State Highway Commissioner, under the original bill, might also appoint, as the work of the department required, the following: Fifteen assistant engineers at $2,400 each, four assistant draftsmen at $1,800 each, four clerks and four stenographers at $1,200 each, two bookkeepers at $1,600 each, and, from time to time, such additional clerks and stenographers at not over $1,000, as might be required. One of the deputies, the chief engineer, the engineer of bridges, the assistant engineer, the chief draftsman and the assistant draftsmen must be civil engineers, and the superintendents of highways must be "experienced in the construction and maintenance of improved roads," according to the bill as originally drawn.

This act was amended at the 1915 session of the Legislature so as to permit the State Highway Commissioner to appoint certain additional engineers and office assistants and to reduce the force at such times as, in his opinion, it was necessary to effect an economical conduct of the affairs of the department.

The department, as reorganized in 1911, continued until early in 1915, when Robert J. Cunningham, of Pittsburgh, succeeded Edward M. Bigelow, also of Pittsburgh, as State Highway Commissioner, Mr. Cunningham having been appointed by Governor Martin G. Brumbaugh in April of 1915.

The present personnel of the department is as follows:

Commissioner, Robert J. Cunningham.

First Deputy, Joseph W. Hunter; Second Deputy, George H. Biles.

Chief Engineer, William D. Uhler.

Auditor, W. R. Main, C. P. A.

Statistician, W. R. D. Hall.
Automobile Division Registrar, George M. Brusstar.
Chief Clerk, Howard W. Fry.
Engineer of Tests, Julius Adler.
Engineer of Bridges, W. Whited.
Chief Draftsman, G. H. Elsenhans.

Assistant Engineers: District No. 1, W. D. Meyers; District No. 2, C. W. Hardt; District No. 3, A. S. Clay; District No. 4, H. W. Claybaugh; District No. 5, W. R. Wolfinger; District No. 6, W. A. Van Duzer; District No. 7, W. F. Cressman; District No. 8, F. E. Winters (acting); District No. 9, W. H. Hammaker (acting); District No. 10, J. S. Ritchey; District No. 11, C. S. Lemon; District No. 12, P. M. Tebbs; District No. 13, S. W. Jackson; District No. 14, A. B. Gray; District No. 15, T. C. Frame.

Under the Sproul bill certain roads included in 296 routes designated in the bill and having a total length of about 9,000 miles were taken over as state highways to be improved at the expense of the commonwealth. In carrying out the provisions of the bill, the State Highway Commissioner, with the approval of the Governor, may relocate roads when the present location is dangerous or inconvenient or when the expense of improvement can be reduced by relocation. Toll roads or other privately owned roads included in a state highway may be purchased by the state or, if necessary, secured by condemnation and the payment of damages and costs. Under certain conditions, highways in boroughs or incorporated towns may also be taken over by the state. Another provision of the bill is that improvements on the state highways shall be made "as equally and uniformly in the several counties as conditions will allow."

Construction and reconstruction work, according to the law, must be done under contracts awarded by the State Highway Department on plans and specifications prepared by the department. The determination of the kind of surfacing lies with the State Highway Commissioner, but all state highways must be improved to a width of not less than 12 ft. and must be constructed so that they will "with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel."

The maintenance of roads improved as state highways must be taken care of by the State Highway Department at the expense of the state, except that 50 per cent. of the cost of maintenance is paid under certain conditions by boroughs or incorporated towns within which state highways are located.

The maintenance work may be done either by contract or directly by the State Highway Department, when done by contract the authorities of boroughs, incorporated towns, townships or counties being allowed to bid on the work.

Among various other provisions of the law is one to the effect that no railroad or street railway may be built on a state highway, nor may any railroad or street railway crossing, any gas or water pipe, any electric conduit or other pipe be laid on any state highway, nor may any telephone, telegraph, electric light or power poles be erected on a state highway, except under such conditions as may be prescribed by the State Highway Department. The law also contains provisions relating to signs and trees, and rules for the use of the roads.

In addition to providing for the improvement of state highways, the Sproul law provides for the extension of aid by the state in the improvement of certain roads not included in the state highway system. Under this portion of the law, counties and townships may receive from the state not more than 50 per cent. of the total cost of improving and subsequently maintaining roads within their limits. If a county and a township make joint application for such aid, each pays 25 per cent. of the cost of improving the road and the township pays 50 per cent. of the entire maintenance cost, unless the county and township agree to bear their 50 per cent. of the total cost of improvement in a different proportion. If a county alone or a township alone applies for aid, that county or township pays 50 per cent. of the cost of improvement and 50 per cent. of the subsequent cost of maintenance. Either a county or a township desiring to take advantage of this aid must levy a cash road tax to meet its share of the cost of the improvement and afterwards must levy an annual cash road tax sufficient to pay for its share of the maintenance cost.

Petitions for improvement may originate with county or township authorities or with the owners of the majority of the assessed real estate valuation in any township. Township officials may petition the State Highway Department through the county commissioners or may send their petition directly to the department. Petitions from property owners, however, must be made first to the township officials, who must then petition the county commissioners, who then proceed as if the petition had originated with the township officials.

The basis of apportioning state aid to the counties is the mileage of township and county roads in the counties. As in the case of state highways, state aid highways are maintained and repaired by the State Highway Department, 50 per cent. of the cost being paid back by the townships in which the roads are situated, or by the counties if the roads have been improved without the cooperation of the townships. Under certain conditions the state may bear a portion of the expense of improving state aid roads within boroughs or incorporated towns.

The Sproul bill appropriated $3,000,000 for the maintenance, repair and construction of state highways and for the payment of the state's share of the maintenance and repair of state aid highways. It also appropriated $1,000,000 to be applied to state aid in the improvement of the roads designated in the bill as state aid highways. Another section of the bill provided that any money in the treasury to the credit of the State Highway Department for the improvement and maintenance of state or state aid highways should remain there for the use of the department until used for the purposes for which it was appropriated.

The Legislature of 1913 made appropriations under which the department operated for the two-year period of 1913 and 1914. The Legislature of 1915 appropriated the sum of $8,300,000 to the State Highway Department for the two fiscal years beginning June 1, 1915, for the following purposes:

Maintenance and repair of state highways, $6,000,000; payment of expenses, cost and awards in the purchase or condemnation of turnpikes forming a part of state highway routes, $250,000; payment of the commonwealth's share in the expense of construction and maintenance of state aid highways, $500,000; rebuilding, repair and maintenance of the National, or Cumberland, Road in Somerset, Fayette and Washington Counties, $50,000; payment of a portion of the deficiency during 1913 and 1914 in carrying out the state laws relative to the construction and repair of roads in second class townships, the sum of $1,500,000.

An important proviso was inserted in this appropriation act. It reads:

"Provided, that the appropriation made by this act shall include and not be in addition to the amounts received by the commonwealth during the two fiscal years beginning June 1, 1915; for the licensing of motor vehicles and drivers, under the act of July 7, 1913."

The money derived from the licensing and registration of motor vehicles had heretofore gone to the State Highway Department in addition to the amounts appropriated by the Legislature for highway department purposes. As the estimated revenue from this source for 1916 will approximate

$2,000,000, it can be seen that the State Highway Department will be deprived of a sum sufficiently large to enable it to construct and maintain many miles of the state highway system which it will be compelled to leave alone because this money is not coming to it.

The General Assembly of 1913 somewhat amplified the work of the Pennsylvania State Highway Department by an act providing for the establishment of a Bureau of Township Highways in charge of one of the deputy state highway commissioners. This act, which went into effect in December, 1913, provides that the deputy commissioner in charge of the bureau shall have general supervision over all township and highway bridges improved or maintained, wholly or in part, by state aid, except as otherwise provided for. It also provides that the deputy highway commissioner in charge of the bureau shall have charge of the administration of township highways through the superintendents of highways provided for in the Sproul bill, each of whom is assigned by the law to a certain division of the state. The law also provides that township highways and bridges shall be administered by the local officials, and stipulates that these officials must levy for the purpose cash road taxes not exceeding 10 mills on each dollar of valuation. Each township operating under the provisions of this act receives from the state annually a grant equal to 50 per cent. of the total amount of road tax collected in the township, provided that no township shall receive in any one year over $20 for each mile of township road. When such aid is had, the work done in the township must be carried out in accordance with rules and regulations prescribed by the State Highway Commissioner, who is also given authority to determine where and how money, levied, collected or received from the state as state aid under the terms of the act, shall be expended.

TABLE I—PENNSYLVANIA STATE HIGHWAYS CONSTRUCTED OR FOR WHICH CONTRACTS HAVE BEEN AWARDED FROM JUNE 1, 1911 TO NOV. 15, 1915.

	Length, miles	Total cost
Water bound macadam	86.23	$717,404.95
Asphaltic macadam	48.79	759,820.86
Asphaltic concrete	48.17	1,005,902.25
Brick	11.74	301,962.51
Cement concrete	2.71	50,718.62

TABLE II—PENNSYLVANIA STATE AID HIGHWAYS CONSTRUCTED OR FOR WHICH CONTRACTS HAVE BEEN AWARDED FROM JUNE 1, 1911, TO NOV. 15, 1915.

	Length, miles	Total cost
Water bound macadam on telford	19.87	$217,017.01
Asphaltic macadam	66.42	1,091,155.12
Asphaltic concrete	24.90	464,694.77
Brick	58.36	1,314,172.05
Cement concrete	4.50	7,404.00

TABLE III—MAINTENANCE MILEAGE STATEMENT—1913—1914—1915.

	1913		1914		1915	
Classifications	S. H.	S. A.	S. H.	S. A.	S. H.	S. A.
Gen'l repairs	6,575.77	115.46	6,583.51	214.63	8,400.00*	140.00*
Resurfacing	105.91	34.48	242.94	127.41	407.59	108.50
Oiling	221.33	....	64.67	7.87	980.69	93.53

*Approximate

Bonds may be issued by counties or townships to secure funds for road improvement or maintenance. Bond issues for road improvement can not be made by the state at present, but for some time efforts have been made to amend the constitution to make this possible. In 1911 the Legislature passed an amendment permitting the state to issue $50,000,000 in bonds for road improvement. This was passed upon again by the 1913 Legislature, in accordance with the law, and was then brought before the people for ratification at the election in November of that year. It was defeated by a majority of 40,000. Again in 1915 the Legislature passed an amendment and, as before, this will have to be passed upon by the next Legislature. If it is passed at the 1917 session it will be submitted to the people at the election in the fall of 1918. It is stated that sentiment in Pennsylvania has changed rapidly during the past two years, and it is predicted that the amendment will pass when submitted again to the people.

The construction work done on state highways and state aid highways under the provisions of the 1911 law and its supplements are shown in Tables 1 and 2. In Table 1 it should be noted that the water bound macadam work includes maintenance contracts where the foundation is partially rebuilt and the brick work includes some construction in boroughs where the pavement is of extra width.

New York City and the Highway Funds of New York State

In the course of the legislative investigation of New York City finances, Mayor Mitchel of New York City took occasion early last month to protest against the method by which New York City is forced to pay a very large proportion of the cost of state road work while receiving no apportionment from state road funds.

The substance of the Mayor's contentions was contained in a letter sent to Speaker Thaddeus E. Sweet of the New York Assembly. In the letter, the Mayor stated that the amendment to the state constitution which authorized the construction of the state highways provided for the equitable apportionment thereof among the counties; that since the amendment was passed bonds amounting to $1,000,000 had been authorized, and that the City of New York was contributing through a direct tax for the retirement of the bonds. In spite of the constitutional provision that the highways provided for would be apportioned among the counties without discrimination, the Legislature of 1907 and subsequent legislatures apportioned these highways to the exclusion of the five counties comprising New York City, according to Mayor Mitchel. He pointed out that as the result of this discrimination, if no amendment were made to this apportionment, New York City would be compelled to pay for the construction of state highways a sum which would eventually amount to $182,000,000, and in return would receive not a single mile of highway. In addition, Mayor Mitchel pointed out that the 12,000 miles of state and county highways apportioned to counties outside of New York City would have to be maintained, when completed, at a cost of approximately $1,000 per mile per year, or, for the total mileage, $12,000,000 annually, of which sum the City of New York would be compelled to contribute at least two-thirds, or $8,000,000 a year. In closing, Mayor Mitchel called attention to the injustice of the situation and stated that there were but two courses open to New York City, the first of which was to appeal to the State Legislature to remedy the situation and the second to appeal to the courts for the city's constitutional rights.

Similar letters were sent to Republican Leader Elon R. Brown and Democratic Leader Robert F. Wagner of the Senate and to Joseph M. Callahan, minority leader in the Assembly. According to reports, Senator Wagner has agreed to the justice of the Mayor's contentions and has promised to attempt to remedy the situation through legislative action. Senator Brown, on the other hand, is said to have intimated that Mayor Mitchel's letter was written for the purpose of attempting to divert him from the legislative investigation previously referred to which he is conducting and to have refused to be diverted to a discussion of "an issue that is peculiarly a matter for discussion at Albany."

Harrison County, Miss., has Issued Bonds to the amount of $640,000 for the construction of a 26-mile brick highway.

January 21 was observed as Good Roads Day by the Schools of Alabama. Officials of the Alabama Good Roads Association visited a number of schools and made addresses. Work was done on a number of roads by students.

Governor Fielder's Recommendations for the Work of Highway Improvement in New Jersey

The need of good roads for national defense, the desirability of raising greater sums for road building by means of a state tax, and the necessity for paying greater attention to maintenance were emphasized in the message of Governor James F. Fielder to the New Jersey Legislature which assembled in its one hundred and fortieth session on January 11. The portion of Governor Fielder's message which relates to roads follows:

"A committee was appointed by the last Legislature to revise road legislation and to lay down a road policy for the state. I hope its investigations will result in a report which will form the basis for intelligent legislation, because the most important and difficult problem now pressing for solution is the improvement and maintenance of our roads. Proper provision for vehicular transportation is of vital moment, not only to our business interests, but the aid the states should give in preparation for national defense, includes a system of highways desirable and suitable for military reasons. The increasing and insistent demand for good roads imposes upon the Legislature the duty of providing them. A few years ago pleasure travel was not so great, and freight, material and commodities of all kinds were generally transported by rail or water. We were then chiefly concerned with the improvement of a few main arteries, so that the farmer and manufacturer could get their supplies and products to and from nearby railroad or water shipping points, or the local markets, by wagon, but we must now reckon with the automobile. We average one automobile for every thirty-two of our population, which means about six automobiles to every mile of our roads, excluding city streets. The Commissioner of Public Roads, in his report for the year recently closed, estimates that an automobile paying an annual license fee of $7.50 and making 6,000 miles a year, damages the roads to the extent of $30 or $35, while the damage caused by the ordinary two-horse team and wagon will not cost over $8 to replace. It is, therefore, evident that the general use of automobiles for pleasure and business purposes adds tremendously to the traffic burdens the roads must bear, and thus the new and difficult problem is presented to us. The Commissioner of Public Roads also estimates the total mileage of the state, exclusive of streets, at 15,000, of which 10,500 are still unimproved, and he says it will cost $51,300,000 to properly improve the whole mileage. The state's share of this expense would be about $15,000,000.

"The annual appropriations heretofore made have been as liberal as the financial condition of the state would permit, and it does not seem possible to materially increase them. Last year the appropriation to the state road fund was $500,000, in addition to which there was the convict labor appropriation and the motor vehicle fund, from which sources the state actually disbursed, for road construction and repair, the sum of $1,235,160.23 as follows:

	Construction.	Repair.
State Road Fund	$301,891.51	......
Convict Labor Appropriation	64,303.90	$17,149.93
Motor Vehicle Fund	......	851,214.89
	$366,795.41	$868,364.82

"This does not take into consideration all moneys expended for salaries and for office and clerical expenses.

"Should the counties be willing to undertake the improvement of all their roads with state aid, and should the state be able to appropriate $500,000 annually, thirty years would elapse before all the roads could be built, and in the meantime some of those improved will have worn out and will require partial, if not whole, reconstruction. It is apparent that our policy of road maintenance and construction requires readjustment, because we cannot, under the plan now pursued, properly maintain our roads with the added uses to which they are put and keep pace with the progress the state demands in building new highways. Other states, recognizing the importance of good roads in the development of the state's municipalities and industries, are spending vast sums for this purpose. How then shall we secure the money the state needs? It is not wise or expedient to raise all the money required at once. The counties could not stand the strain and the Road Department could not be so organized as to handle the vast amount of work which would follow an attempt to construct ten thousand miles of road in one or two years. Perhaps there should be a slight increase in automobile license fees and a portion of these fees devoted to construction work, but it is not just that automobile owners should bear the whole cost, because improved roads benefit the owners of other vehicles; they bring more buyers to the merchants' doors; through them, property owners see increased land values, and nearly every individual, including non-road users, gets the benefit of commercial automobile travel, in quicker and cheaper transportation of commodities. I think, and therefore advise, that the necessary funds should be raised by a state tax laid specially for road construction purposes and that the work should be spread over a period of fifteen years, in which event the state would need a million dollars annually—or over ten years, for which a million and a half dollars would be required for each year. The State Board of Taxes and Assessment has recently reported the assessed valuation of the real and personal property of the state, subject to local taxation, as $2,583,953,595.29. To raise a million dollars, a state tax of less than four-tenths of a mill would be necessary and a tax of less than six-tenths of a mill would raise a million and a half dollars. This small tax, amounting to but forty or sixty cents on each thousand dollars of assessed valuation, would not be felt, and I believe would be willingly paid, if it were to be the means of securing a magnificent road system.

"Alignment, grading and guttering and the construction of bridges is work of a permanent nature, while the foundation, if skillfully and honestly laid, will last for years and will not need frequent renewal. Annual state appropriations and the automobile license fees could be wholly devoted to maintenance and resurfacing work and thus we could keep our roads in first-class condition, but you should also provide for a definite and comprehensive system of road maintenance by patroling squads, not only for state highways, but for every road which the state aids in maintenance or repair. The present method of constructing a road and then permitting it to wear out, is unbusinesslike and wasteful in the extreme.

"The work of the counties on road building is also unbusinesslike, in that it lacks uniformity in policy as to the kind of material used, the method of construction and failure in cooperation between counties in connecting up highways. A policy adopted this year is subject to alteration next year through changes in the Board of Freeholders. The county engineering department and road employees change, too, with changes in membership in their boards. The counties are parts of a great whole, separated only by a stream, by a road, or by an imaginary line, and for the whole a definite policy for road construction should be laid down by you, to be carried out under the direction of the state department, by county engineers, supervisors and inspectors who should be experts, protected by tenure of office and not subject to every political change that may occur."

The Old National Road in Pennsylvania

By **JOHN RUSSELL WILSON***

The road which forms the subject of this sketch is the only one of its length wholly constructed by the United States Government. In the year 1806 when Jefferson was President, the proposition for a national road was presented to Congress, Henry Clay being its most ardent supporter. To a Mr. Gallatin the credit is given for being the first man who suggested the building of the Cumberland Road.

From the time it was thrown open to the public in 1818 until the coming of the railroads west of the Allegheny Mountains in 1852, the National Road was the one great highway over which passed the bulk of trade and travel and the mails between the East and West. Its many stately stone bridges, its iron mile posts and its old iron gates attest the skill of the workmen engaged on its construction and to this day remain monuments of its grandeur. Many illustrious statesmen of the early period traveled over this road. So did it have its quaint characters, eccentric men, or rather loafers, who were indigenous to the road, could not live away from it and enjoyed the precarious subsistence they obtained on it. The probable loadstone that attracted them and attached them to the road was the pure whiskey which was plentiful and cheap and could be obtained almost for the asking. However, it did not contain the elements of modern whiskey nor did it have the effect of the whiskey of the present day.

AT "TURKEY'S NEST" ON THE OLD NATIONAL ROAD IN PENNSYLVANIA—IMPROVED SECTION ON THE WESTERN SLOPE OF LAUREL, OR CHESTNUT, RIDGE—ASPHALTIC ROADWAY.

The road is also famous for its traditions and legends as well as for the strange names that have been applied to particular localities, such as Woodcock Hill, Chalk Hill, Laurel Hill, Turkey's Nest, Eggnog Hill, and Coon Island.

Eggnog Hill is called so from the fact that at the time of the completion of the road on Christmas Day, a barrel of eggnog was made and drunk by the contractor and his coworkers. Likewise this road was noted for its many excellent taverns or wagon stands as many of them were called, and by the side of each tavern stood an immense water trough filled to the brim with fresh, sparkling water where the weary beast might drink his fill.

In it palmy days as many as twenty four-horse coaches have been counted in line at one time, together with a large number of Conestoga wagons laden with merchandise and produce, giving the road the aspect of a busy city street.

The National Road, or Pike, as it is commonly called, enters the state of Pennsylvania on the eastern slope of Winding Ridge and climbs to the summit of this ridge, thence by a number of graceful curves down the western slope to the village of Petersburg, now called Addison, thence west to the valley of the Youghiogheny River, crossing the river at what is known as Big Crossings, or the town of Somerfield, into Fayette County, thence to Jockey Hollow which is about one mile from Somerfield. Jockey Hollow derived its name from the fact that as this mile of road is very level it was the scene of many spirited races in the days of the stage-coach, between the drivers of the stages of competing lines. The road now begins the ascent of Jockey Hollow Hill and thence up Woodcock Hill. From the top of Woodcock Hill there is the longest straight piece of this road in Pennsylvania, being an almost direct line for a distance of seven miles. Before reaching the hill known as Mt. Washington we pass the site of Fort Necessity on the left and Braddock's grave on the right. The plot of ground surrounding Braddock's grave has recently been repaired and a monument erected, a memorial service being held at the time. This was under the auspices of the Centennial Celebration Committee.

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*Consulting Engineer, Washington, Pa.

BRIDGE CARRYING THE NATIONAL ROAD OVER THE YOUGHIOGHENY RIVER, AFTER RECONSTRUCTION.

Two miles further on we reach the foot of the eastern slope of Laurel Ridge. The road here winds up the side of the mountain through a forest of mighty chestnuts and is one of the most picturesque points along the road. At this point the road reaches its highest elevation, which is 2,417.33 ft. above sea level. The road now descends the western slope of Laurel Ridge and enters the city of Uniontown. From Uniontown westward to the Monongahela River the road traverses a more rolling country. Crossing the Monongahela River into Washington County it passes through the towns of Centerville, Beallsville, Scenery Hill, Washington, Claysville, and West Alexander. One mile west of West Alexander it crosses into the state of West Virginia, making eighty miles of the National Road in Pennsylvania.

A trip over this famous old highway would well repay one, as nowhere in this country can be found so many miles of beautiful scenery or places more replete with historical lore.

The work on the old pike was begun in 1817 and carried on by the government until 1835. I will not go into detail previous to 1835, at which time the road by acts of Congress and the state Legislature, was turned over to the state which was to have full authority over same, giving it the right to erect toll houses and collect toll.

Section 2 of an act passed April 4, 1831, by the Senate and Legislature of Pennsylvania, reads: "For the purpose of keeping so much of said road in repair as lies in the state of Pennsylvania and paying the expense of collection and other expenses, the Commissioners shall cause to be erected on so much of the road as passes within this state, at least six gates and as soon as said gates and toll houses shall be erected it shall be the duty of the Toll Collector, and they are hereby required to receive for passing the said gates, the tolls hereinafter mentioned and they may stop any person riding, leading or driving any horses, cattle, sulky, phaeton, cart, chaise, wagon, sleigh, sled or other carriage of burden or pleasure from passing through said gates, until they shall respectively have paid for passing same, that is to say"—(Here followed rates, etc.).

MODERN CONCRETE BRIDGE ON THE NATIONAL ROAD NEAR SCENERY HILL, PENNSYLVANIA.

The act goes on further to say that it shall not go into effect until the Congress of the United States shall assent to it. Ohio accepted this road from the government under similar conditions in February, 1831, but Pennsylvania, which was more exacting in its terms, did not accept it until April 1, 1835.

The tolls collected were found inadequate to keep the road in proper condition and it was allowed to deteriorate and in many places was almost unfit for travel until in June, 1905, by an act of Legislature, the collection of tolls was abolished in Fayette and Washington Counties, and June 1, 1907, in Somerset County, and the care and maintenance of the road were turned over to the State Highway Department.

The writer was the first engineer for the reconstruction of this road in Pennsylvania under the State Highway Department and acted as such until 1911. During that time about fifteen miles of road was reconstructed and surveys and plans made for the reconstruction of sixty-five miles. Survey was made of all bridges and those in need of immediate repair were repaired during 1905, 1906 and 1907.

AN OLD STONE TOLL HOUSE ON THE NATIONAL ROAD NEAR ADDISON, PENNSYLVANIA.

In the repair of the road proper, the old telford foundation was used where possible, although in a number of places new foundation had to be placed as the old foundation had entirely disappeared. Especially was this true in Washington County, as the superintendent under the previous regime had had the old telford removed, crushed and placed on the road as macadam.

The methods used by the State Highway Department after replacing any worn out telford and bringing the road to an even grade with native stone were to resurface the old road to a width of 16 ft., with approximately 6 ins. of crushed limestone ranging in size from that which would pass through a 2½-in. ring to ¼-in. stone, the residue being used as a binder after the road had been thoroughly rolled with a roller weighing not less than ten tons. In 1911 this was changed and contracts were let for resurfacing with asphaltic macadam. The size of stone used was practically the same as that used in water bound macadam, the only difference being that asphalt was used as a binder, This latter method of construction was used on the eastern and western slopes of Laurel Ridge, four miles west of Uniontown, and on four miles of road between Claysville and Washington.

A portion of the road adjacent to Uniontown was paved with brick, 16 ft. wide, sufficient native stone being used to bring the roadbed to grade before laying the sand cushion and brick. This was also done in the village of Claysville, Washington County. These methods of reconstruction cost from $7,000 to $15,000 per mile, depending, of course, on location and the material used.

But little work was done in 1912, owing to lack of appropriations by the Legislature. The work was again taken up in 1913 and has since been carried on extensively under the supervision of the state, and at the present time all this road in Pennsylvania, with the exception of about fourteen miles, has been repaired, and the greater part of this fourteen miles is under reconstruction.

In making surveys and plans for this work, much trouble was experienced in locating the original lines, as the records of the old surveys were very meager. Our method was to locate the old foundation, if possible, at each angle point and then take the center. This was done on the entire eighty miles. We also found that many landowners had encroached on the roadway, and in many cases it required something more than "gentle persuasion" to make them move buildings, fences, and the like, off the road limits, i. e., 33 ft. from the center line.

SECTION OF OLD NATIONAL ROAD BEFORE IMPROVEMENT—TELFORD PROJECTING FROM SURFACE.

The bridges previously mentioned, of which there are twenty-three, ranging in span from 10 to 80 ft., were nearly all stone arches constructed of a very good grade of native stone.

The first bridge repaired was the one over the Youghiogheny River, which has three arches of 50 ft., 60 ft., and 70 ft. span, respectively. The two center piers of this bridge had been practically destroyed by time and tide, as it was built in 1819. In repairing it the first step was the building of a coffer dam around the old piers at a distance of 3 ft. Excavation was then made to the bottom of the foundation of the piers and this space filled with concrete. From the mean water line the piers were given a batter that brought them to a thickness of 18 ins. at the spring line. Before placing the concrete the old joints were raked out so that the concrete would readily flow into them. The joints of the spandrel walls were all raked clean to a depth of 1 in. and repointed with a cement mortar consisting of equal parts cement and sharp river sand.

NATIONAL ROAD AT THE SUMMIT OF LAUREL RIDGE OVER 2,400 FT. ABOVE SEA LEVEL.

As a great deal of trouble had arisen from the drainage of the roadbed of the old bridge the macadam roadway was removed and a 1:3:5 concrete foundation, 4 ins. in thickness, was placed on the road. On this a macadam wearing surface, 6 ins. in thickness, was laid. A concrete walk was built on one side of the bridge and gutters were made for the surface drainage. This has proved very satisfactory.

The second bridge repaired is located about one mile west of the Youghiogheny River over a stream known as Jockey Hollow Run. It was originally a 40-ft. span arch bridge, the water passing under it diagonally. This bridge was entirely removed and a 26-ft. span skew bridge built in its place, using I-beams and concrete for the floor, the abutments and walls being built of the stone from the old bridge. This was the procedure in the reconstruction of all the bridges, an effort being made to use as much as possible of the old material. The cost of this construction averaged from $5 to $10 per cu. yd.

In 1908, at a point one mile east of Scenery Hill in Washington County, the Pennsylvania Railroad cut through the National Road with a branch line, making it necessary to construct a viaduct. After several designs were carefully studied it was decided to build a reinforced concrete viaduct. This viaduct is composed of three parabolic arch ribs supporting the floor system on columns erected from the ribs. The bridge was built under the supervision of the State Highway Department, but was paid for by the railroad company.

At this writing all the bridges on the National Road in Pennsylvania have been repaired or rebuilt. In two years more the entire road in Pennsylvania will be completed and will be one of the most popular automobile routes from the East to the West.

OLD NATIONAL ROAD IN PENNSYLVANIA RESURFACED WITH ASPHALT AND BROKEN STONE.

The Highway Construction and Maintenance System of Allegheny County, Pennsylvania

Allegheny County was created by an act of the Pennsylvania Legislature approved on September 24, 1788. It was taken from Westmoreland County and included all the territory west of the Allegheny River and north of the Ohio River to the western boundary of the state. In 1800 the territory was divided into several counties. The present area of the county is approximately 757 square miles.

The county was named Allegheny for a tribe of Indians called the "Alleghans," who lived along the banks of what is now the Allegheny River. Pitt Township, in 1771, included all of the present city of Pittsburgh and portions of what are now Beaver, Washington and Westmoreland Counties. The township at that time contained 52 landowners, 20 tenants and 13 single freemen.

The present county of Allegheny includes 2 cities, 71 boroughs and 56 townships and has a population of from 1,000,000 to 1,125,000, the census of 1910 having placed the population at 1,018,465. The 1915 valuation of property in the county was $1,228,618,600, and it is estimated that the 1916 assessment will amount to approximately $1,253,000,000. These figures do not include what is termed "personal property," the personal assessment amounting to about $260,000,000. It is stated that the real valuation of the county is greater than that of Maine, New Hampshire and Vermont combined, and that if the county were classed as a state it would rank about thirteenth in taxable valuation.

An act generally known as the "Flinn Act," authorizing the county commissioners of the various counties to organize road departments to look after the improvement of the county roads, was approved on June 26, 1895. This act as amended in 1911 comprises the law under which the present Road Department of Allegheny County is operated. The law permits the issuing of bonds to pay for road work and the levying of a special tax to provide for a sinking fund and maintenance charges. Bonds may be issued to an amount equal to 2 per cent. of the total assessed valuation of the county, and in Allegheny County it is customary under ordinary conditions to issue bonds to the amount of $1,000,000 annually. The road tax of one mill, which is levied, nets about $1,200,000 annually. To date, bonds to the amount of about $13,000,000 have been issued in the county.

The present Board of County Commissioners consists of Addison C. Gumbert, Frank J. Harris and Gilbert F. Myer. The personnel of the Road Department is as follows: Road Commissioner, Wm. McClurg Donley; Chief Engineer, T. F. Maloy; Chief Clerk, C. H. Arnold.

EVERGREEN ROAD EXTENSION IN ALLEGHENY COUNTY, PENNSYLVANIA—MACADAM ROADWAY WITH AN ASPHALTIC SEAL COAT.

The Allegheny County Road Department started work early in 1897 and has since done a large amount of work in carrying out the original program, which comprised the improvement, first, of the main routes, and then of the connecting links. On Jan. 1, 1916, 520.5 miles of the roads in the county system had been completed or were under construction and of that total mileage only 22 miles consist of what may be termed "temporary improvements." These temporary improvements cover sections of the old Butler and Perrysville Plank Roads, which are condemned toll roads purchased by the county and freed. The mileage of improved roads within the county is somewhat greater than the total given, as the State Highway Department, under joint agreements with the county and different boroughs and townships, has improved approximately 20 miles of highway.

Until May 31, 1913, the county was handicapped in its efforts to complete various links in the county system by its inability to do work within the limits of boroughs. At that time, however, an act was passed which authorized the county to do such work. A considerable number of the boroughs at once made application for such improvements, and during the past two years much of this work has been done.

For some time the construction of telford macadam roads gave satisfactory results. With the coming of motor trucks and the increase in the weight of loads carried by them and also in the speed at which they traveled, these roads began to wear out rapidly, and during the past six years more permanent and expensive wearing surfaces have been necessary. In work during that period there have been put down roads of macadam, asphaltic concrete (including Warrenite and Amiesite), asphaltic macadam, rock asphalt, concrete and brick roads. Brick has been used on a number of the main routes radiating from the city of Pittsburgh and subjected to heavy traffic. Asphaltic concrete surfacing was adopted by the country in 1910 and is said to have given excellent satisfaction.

FRANK J. HARRIS,
Member of the Board of County Commissioners.

ADDISON C. GUMBERT,
Member of the Board of County Commissioners.

GILBERT F. MYER,
Member of the Board of County Commissioners.

WM. McCLURG DONLEY,
Road Commissioner.

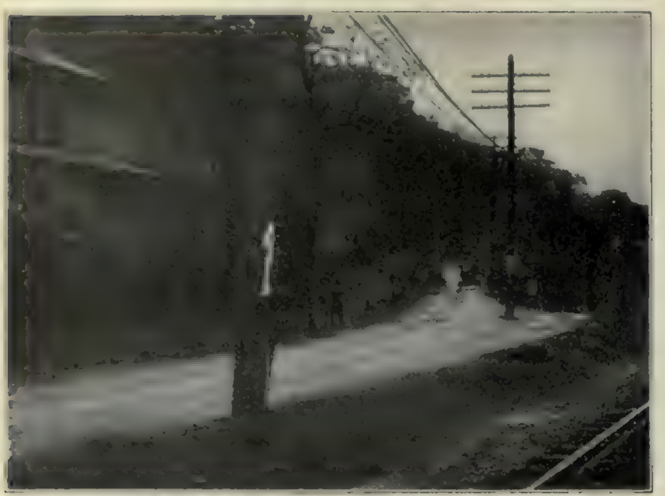
T. F. MALOY,
Chief Engineer.

Board of Commissioners and Road Officials of Allegheny County, Penn.

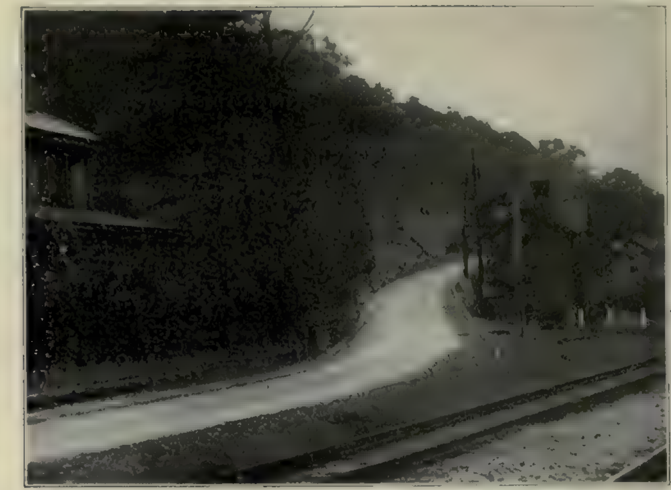
The topography of Allegheny County makes road construction expensive, both because of heavy grading and the necessity for building bridges and retaining walls. It is stated that grading on the average road amounts to from 8,000 to 9,000 cu. yds. per mile, while on some grading work done it has amounted to 21,000 and on a very recent improvement to 26,000 cu. yds. In addition, the cost of hauling materials has been very large, especially during the past few years on account of the distances from the work to railroads and electric railways. Practically all of the road material used in the county has to be shipped in from other parts of the state and the hauling is a very important item. All of the material for macadam has to be secured from the foothills of the Allegheny Mountains or from the New Castle or Wampum limestone fields. The material obtained from the mountains is commonly called "Ligonier stone" and is very hard. Its cost, f.o.b. cars Allegheny County, ranges from $1.22 to $1.60 per ton. The haulage from the cars to the roads varies from $0.50 to $1.79 per ton.

Some very expensive roads were constructed during 1915, among them the Duquesne and Dravosburg Road, between the boroughs of Duquesne and Dravosburg in Mifflin Township. The preliminary surveys showed five grade crossings on the Monongahela Division of the Pennsylvania Railroad, and to eliminate these it was necessary to locate the new road along a hillside, this necessitating heavy cutting and filling and the building of long retaining walls. The improvement was completed at a cost of $97,484.67, the total distance being 1.76 miles. The completion of the road provides direct connection between the two boroughs and connects up from 35 to 40 miles of road previously constructed by the county.

Another improvement which has provided improved transportation facilities is the completion of the Glenfield section of the Emsworth and Haysville Road. The improve-



EMSWORTH AND HAYSVILLE ROAD, GLENFIELD SECTION, ALLEGHENY COUNTY—BEFORE IMPROVEMENT.



ROAD SHOWN IN ILLUSTRATION AT THE LEFT, AFTER IMPROVEMENT—BRICK PAVEMENT.

ment is situated wholly within the borough of Glenfield and affords a more direct connection between the city of Pittsburgh and what is known as the Sewickley Valley. The road is 1.24 miles in length and reduces the distance from Pittsburgh to Sewickley about 8 miles.

THOMS RUN AND OAKDALE ROAD—ALLEGHENY COUNTY—CONCRETE PAVEMENT.

DUQUESNE AND DRAVOSBURG ROAD—BRICK PAVEMENT—SHOWING RETAINING WALLS.

Water bound macadam with an asphalt seal coat was laid in 1914 and 1915. The average cost for the season of 1914 was 50.01 cts. per sq. yd., and in 1915, 57.46 cts. per sq. yd. Water bound macadam reconstruction work during 1915 cost 46.9 cts. per sq. yd., compared with 48.8 cts. in 1914, 48.1 cts. in 1913, 45 cts. in 1912 and 38.4 cts. in 1911.

The average cost of asphaltic concrete laid in 1910 was $1.26 per sq. yd.; in 1911 the average cost per square yard of reconstructing 261,000 sq. yds. amounted to 97.7 cts.; the cost of constructing approximately 311,000 sq. yds. in 1912 was $1.022 per sq. yd.; in 1913 the unit cost was $1.165

SECTION OF THE DUQUESNE AND DRAVOSBURG ROAD—HEAVY FILL UNDER CONSTRUCTION.

ROAD SHOWN IN ILLUSTRATION AT THE LEFT, AFTER COMPLETION OF GRADING AND PAVING.

per sq. yd. for reconstructing 277,300 sq. yds.; in 1914, $1.1005 per sq. yd. for constructing 263,300 sq. yds., and in 1915, $1.1945 per sq. yd. for constructing 113,900 sq. yds.

During the past five years considerable road oil has been used in the county for surface treatments, the cost ranging from 2.08 cts. per sq. yd. in 1910 when 310,000 gals. were used to 1.836 cts. per sq. yd. for such work during 1914. Very little oiling was done during 1915 as many of the water bound macadam roads had been reconstructed with brick or asphaltic concrete.

During 1915 roads were completed and accepted as shown in the following table:

Kind of Road.	Length Miles.	Cost.
Macadam	11.35	$212,786.89
Brick	10.92	365,356.89
Concrete	1.88	40,931.85

Maintenance work has been a very important part of the work of the county road department. The work is directed by the Road Commissioner through four assistant superintendents, who have charge of reconstruction work and general maintenance items. These assistant superintendents are required to look after certain districts, each of from 100 to 125 miles of completed work, and are equipped with Ford runabouts so that they can cover their territory. The work of maintenance is performed by a force of from 125 to 130 caretakers, employed throughout the entire year by the county. These caretakers are required to look after the ordinary maintenance matters such as the removal of loose material in the road, the keeping open of drains and sewers, the removal of obstructions and such work. They are equipped with wheelbarrows, picks, shovels, hoes, rakes and other small tools and are paid at the rate of $60 per month. Each caretaker, under ordinary conditions, is required to take care of a section of road from 4 to 5 miles in length and must make weekly reports to the department.

The county maintains its own equipment for maintenance and repair work. The equipment includes ten 10-ton, 3-wheeled rollers, 3 lighter tandem rollers, water wagons, sweepers, oil wagons and a 5-ton motor truck used both for applying oil and asphalt and for transporting material for patching. All this equipment is thoroughly overhauled each winter so as to reduce to a minimum delays for repairs during the road building season.

Federal Aid Bill Passed by the House of Representatives

A bill providing for federal aid in the construction of roads was passed by the House of Representatives of the United States on January 25. The bill was introduced by Representative Dorsey W. Shackleford, of Missouri, Chairman of the House Committee on Roads, to which the multitude of bills providing for federal aid which were introduced during the early days of the present session were referred.

The measure (H.R. 7617) is entitled "A Bill to provide that in order to promote agriculture, afford better facilities for rural transportation and marketing farm products and encourage the development of a general system of improved highways, the Secretary of Agriculture, on behalf of the United States, shall, in certain cases, aid the states in the construction, improvement and maintenance of roads which may be used in the transportation of interstate commerce, military supplies or postal matters."

Section 1 provides for an appropriation not exceeding $25,000,000 for any fiscal year to be expended for the improvement of "rural post roads," such roads being defined as any public roads over which mail is, or might be, carried outside of an incorporated city, town or borough having a population exceeding 2,000 and in such cities, towns and boroughs having a population exceeding 2,000, but in which houses average more than 200 ft. apart.

Section 2 provides that after deducting the sum necessary to meet the cost of administration, the appropriation made shall be apportioned to the several states as follows: "$65,000 to each state and one-half of the remainder in the ratio which the population of each state bears to the population of all of the states as shown by the latest available federal census and the other half of such remainder in the ratio which the mileage of rural free delivery and star mail routes in such state bears to the mileage of rural free delivery and star mail routes of all the states as shown by the latest available report of the Postmaster General: Provided, That no portion of this appropriation shall be used in the construction, maintenance or repair of all toll roads."

Section 3 provides that the Secretary of Agriculture shall transmit to the state highway department of each state having such a department and to the governor of each state which has no highway department a statement showing the amount available to the state. The state highway department may then apply for aid and, if the road for which the improvement is asked comes within the provisions of the act, the Secretary shall request the state highway department to furnish him with surveys, plans and specifications, estimates of cost and any other information he may consider proper. The proportion of aid to be given to any project is left to the state highway department. The Secretary of Agriculture shall examine the surveys, plans and estimates, and transmit to the state highway department a written statement of his determination, upon receipt of which the state highway department may notify him that the work will be undertaken in accordance with the terms proposed. The work may then be undertaken by the proper authorities of the state and carried out in compliance with the surveys, plans and specifications, after which the Secretary of Agriculture, upon finding that the work has been done in accordance with the plans and specifications, must pay to the state whatever remains unpaid of the allotment. The Secretary of Agriculture may make payments from time to time as the work progresses, but in no case must the total amount paid be more than "the pro rata part of the United States of the value of labor and materials which have been put into such construction, improvement or maintenance."

Section 4 provides that all work under the act shall be done under the supervision and control of the state highway departments of the several states provided that until Jan. 1, 1920, the amount which has been apportioned to any state having no state highway department shall be available for expenditure in such manner as may be agreed upon by the Secretary of Agriculture and the governor of that state. This section also provides that the Secretary of Agriculture may make inspections and may prescribe what reports shall be made to him by the state highway department and when these reports shall be made. The section also empowers the Secretary of Agriculture to employ such assistants and clerks, to purchase such materials and supplies and to prescribe such rules and regulations as may be necessary for the administration of the act.

Section 5 provides that the necessary culverts and bridges shall be considered parts of the roads improved under the act and that the roads which may be constructed, improved or maintained shall include "earth, earth-oiled, sand-clay, sand-gravel, and other common types of roads, as well as roads of higher classes, one of the purposes of this act being to encourage and promote the improvement of a general system of roads leading from cities, towns and railway stations into the adjacent farming communities."

Section 6 specifies the method by which the payment of federal aid shall be made.

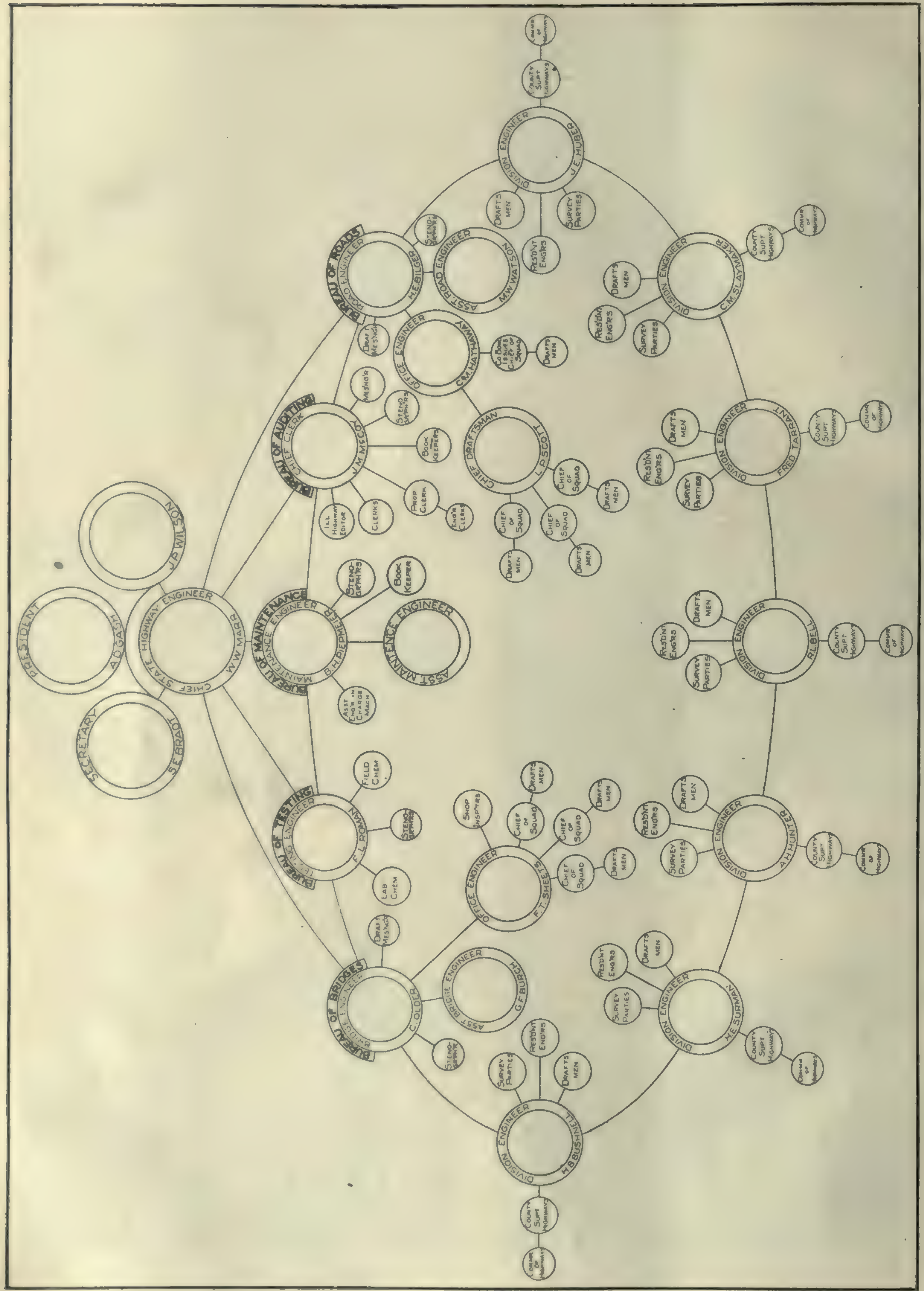


CHART SHOWING THE ORGANIZATION OF THE ILLINOIS STATE HIGHWAY DEPARTMENT.

Organization of the Illinois State Highway Department

By W. W. MARR
Chief State Highway Engineer

In 1913 the Legislature passed a law revising the laws of Illinois in relation to roads and bridges and creating a state highway department with new powers and duties.

A state highway commission of three members was provided, to be appointed by the governor and to have general control of the department. A state highway engineer, appointed by the governor, was also provided, to be the executive officer of the commission. Such employees as were necessary to carry on the work of the department were to be appointed through competitive civil service examination.

The work of the department has grown by leaps and bounds and it has recently been necessary to reorganize the force along permanent lines. The accompanying chart will illustrated perhaps as clearly as possible the organization as it has been adopted. The work of the department has been divided into five character divisions or bureaus with a bureau chief in charge of each of the five main divisions. These are respectively: The Bureau of Bridges, Bureau of Testing, Bureau of Maintenance, Bureau of Auditing and Bureau of Roads. The various bureau chiefs have responsible charge of all the work of the department of the particular character to which they are assigned.

The work is further subdivided along territorial lines into seven districts, each under the direction of a division engineer who is in direct responsible charge of all characters of work in his district. The division engineers report to the respective bureau chiefs in accordance with the character of the work involved. Each division engineer is located in a permanent office in his division and has an independent organization of his own, reporting directly to him in all matters.

In addition to the division engineers, each bureau chief has reporting to him an independent office force, for which he is directly responsible. There is in the organization no conflict of authority or division of responsibility. It will be noted from an inspection of the chart that no member of the department reports to or receives orders from more than one superior. The various assistants report to their immediate superior and wherever an assistant has a specific branch of work assigned to him, his subordinates report only to himself.

On the other hand, no member of the department is authorized to issue instructions to any but his immédiate subordinates, which operates to clearly and definitely define authority and responsibility in all cases and to obviate the confusion which naturally results when a superior officer attempts to direct work over the heads of intermediate officials.

Owing to the vast territory in which the department operates and the scattered condition of the work, the overhead and engineering cost has been comparatively high in the past, but due to the establishment of division engineers in permanent quarters, and otherwise perfecting the present organization, the cost of engineering has been greatly reduced and the efficiency of our men has been materially increased.

Probably the greatest factor in the work of the department at the present time is the phenomenal growth of sentiment for the construction of systems of roads by counties. This is a very different problem from the piecemeal construction of short stretches of road at widely separated points. By means of state aid, the construction of one road is simple in comparison to improving a comprehensive system of roads in a county.

Approximately thirty counties in the state are now contemplating bond issues for the improvement of state aid roads in the respective counties, and from present indications upward of $20,000,000 in bonds will be voted for this purpose during the next eighteen months. This has taxed to the limit our facilities for making preliminary plans and investigations and we are at present working all available men on this phase of the problem.

The department furnishes to counties contemplating bond issues, a number of different tentative plans for a comprehensive system of county roads, on designated state aid lines, for their consideration. The county boards then take up the matter usually through a committee which investigates and recommends some particular plan. If the action of the county board is favorable, the question of issuing bonds is submitted to the people at a special election called for the purpose. The amount of money which a county may raise in this manner is limited by the constitution to 5 per cent. of the assessed valuation of all property in the county, less any outstanding county bond indebtedness. This is usually sufficient in any county to build a complete system of roads composed of various types adapted to the amount and character of traffic on each particular road.

A. M. Nelson Appointed State Highway Engineer of Tennessee

A. M. Nelson has been appointed State Highway Engineer of Tennessee, in which state a State Highway Commission was established last year in accordance with an act passed by the 1915 Legislature.

A. M. NELSON,
State Highway Engineer of Tennessee.

Mr. Nelson, who is a native of Virginia, commenced his engineering career in 1883. Until 1909 he was employed by the Pennsylvania R. R., the Pennsylvania Construction Co., the Kansas City Southern Ry. and the Kansas City, Mexico & Orient R. R., the latter work being in Mexico.

In 1909 Mr. Nelson returned to Tennessee, and later became Assistant Engineer with the Oregon Short Line, in which position he had charge of the valuation of its properties and of construction of all kinds, specializing in locating and constructing bridges.

AMERICAN ROAD BUILDERS' ASSOCIATION

150 NASSAU STREET
NEW YORK, N. Y.

President
GEO. W. TILLSON, Brooklyn, N. Y.

First Vice President
A. W. DEAN, Boston, Mass.

Second Vice President
A. B. FLETCHER, Sacramento, Cal.

Third Vice President
(Office to be filled.)

Secretary
E. L. POWERS, New York, N. Y.

Treasurer
W. W. CROSBY, Baltimore, Md

Through the courtesy of the publisher of "Good Roads," this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

The Association and Its Conventions

Within the next month the American Road Builders' Association will have held its thirteenth annual convention and the seventh exhibition of road and street machinery and materials made under its auspices. Everything indicates that the convention and show, which will be held at Mechanical Hall, Pittsburgh, Pa., February 28-March 3, will mark another success for the Association, and it is hoped that changing the date of the show to a time when road and street officials, engineers and contractors are not so crowded with work will result in an even larger attendance of road builders than at the previous successful meetings of the organization.

About thirteen years ago a few of the principal state highway officials of the country organized the American Road Makers' association, as the A. R. B. A. was then called. The first convention was held at Detroit, Mich., Feb. 13 and 14, 1903, and was so much of a success that another meeting was held the following year at Hartford, Conn., on Feb. 10 and 11. Over eleven hundred were present at this meeting. The next convention was held at Port Huron, Mich., on Aug. 29, 30 and 31, the length of the convention having been increased to three days as a result of the gratifying attendance and general success of the Hartford meeting. The next convention was held at Pittsburgh, Pa., on March 12, 13 and 14, 1907, and was attended by 1,245 delegates. The fifth convention was held at Buffalo, N. Y., July 7 and 8, 1908, and the sixth at Columbus, Ohio, on Oct. 26, 27, 28 and 29, 1909.

The Columbus convention marked several changes in the character and conduct of the convention. By this time the Association had come to occupy a greater field and the organization had become both larger and more influential. The number and importance of the subjects coming up for discussion had become such that a four-day meeting was necessary, and the large attendance at previous conventions had shown the desirability of making the annual A. R. B. A. convention the most notable event of the year in road building circles. At the Columbus convention the first exhibition of road and street machinery and materials was made, and this proved to be so successful that it has now become an established feature of the Association's annual convention.

During 1910 the name of the organization was changed to the American Road Builders' Association and the organization was chartered, without capital, under the laws of the state of New York. This step was taken because of the increased activities of the organization, which have been alluded to, and because it was foreseen that the Association was destined to become the leading organization of its kind in the country, if not in the world.

The seventh annual convention was held at Indianapolis, Ind., on Dec. 6, 7, 8 and 9, 1910, an exhibition of machinery and materials being a part of the convention as at the previous meeting. Over fourteen hundred delegates were registered at the Indianapolis convention. The eighth annual convention was held at Rochester, N. Y., Nov. 14, 15, 16 and 17, 1911; the ninth at Cincinnati, Ohio, on Dec. 3, 4, 5 and 6, 1912; the tenth at Philadelphia, Pa., on Dec. 9, 10, 11 and 12, 1913, and the eleventh at Chicago, Ill., on Dec. 14, 15, 16, 17 and 18, 1914.

At the conventions previous to that held at Rochester in 1911 the program had comprised addresses and papers on various subjects connected with road building, but had not been arranged logically nor with any provision for open discussion. In other words, the meetings of the organization had been conducted in the manner in which most "road" meetings are still conducted. In preparing the program for the Rochester convention a change was made and each session was devoted to the consideration of certain topics, each of which was introduced by a formal paper prepared by some authority on the subject assigned to him. The presentation of each formal paper was followed by two formal discussions, prepared by speakers selected for their ability to handle their subject, after which the topic was thrown open to discussion by the convention at large. The arrangement of the program in an orderly manner considerably reduced the number of formal papers and the opening of the topics to general discussion provided for what has since proved to be one of the most valuable features of the annual convention. Practically this same plan has been followed at all of the A. R. B. A. conventions held since 1911.

From the inauguration of the exhibition feature in 1909, the road shows held in conjunction with the conventions have increased both in the variety and the extent of the displays made. At the Columbus exhibition there were nearly forty separate exhibits; at the Chicago convention in 1914 there were over one hundred exhibitors. The exhibits have included practically all the equipment and materials used in the construction, repair and maintenance of city streets and country roads and have proven of great interest to the delegates and of great value to both the delegates and the manufacturers and dealers making the displays.

The twelfth annual convention was held at Oakland, Cal., on Sept. 13, 14, 15 and 16, 1915, the meeting being held in conjunction with the annual convention of the American Highway Association. This joint convention was designated as the Pan-American Road Congress and was participated in by the Tri-State Good Roads Association and the Pacific Highway Association. The reasons for holding this joint meeting are well known to readers of this page. On account of the Panama-Pacific International Exposition many conventions were held at the Coast in 1915, and it was felt that the American Road Builders' Association and the American Highway Association could advantageously combine their meetings for that year and hold the joint meeting in Oakland.

The decision to change the time of holding the convention from November or December to February or March was reached by the Board of Directors after long and careful consideration of the proposed step. It was felt that a convention in February or March could more readily be attended by many engineers and contractors, as at that season they are as a rule the least busy. It was also felt that a convention shortly before the opening of the working season would be of more practical value than one held shortly after the close of active work.

In previous years it has been customary for "Good Roads" to print in the issue immediately preceding the A. R. B. A. convention an historical sketch of the organization, a list of the officers, and the program of the convention. This is impossible this year because at this writing the program has not been completed and, in addition, the holding of the annual meeting for the election of officers on Friday, Feb. 4, the date previous to publication, does not permit printing here the names of the new officers or their portraits. The officers for 1915 were: President, George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.; First Vice President, A. W. Dean, Chief Engineer, Massachusetts Highway Commission; Second Vice President, Austin B. Fletcher, State Highway Engineer of California; Secretary, E. L. Powers, Editor, "Good Roads;" Treasurer, W. W. Crosby, Consulting Engineer, Baltimore, Md. The late Percy Hooker was Third Vice President. He died in March, 1915, and no successor was appointed to the office he had held. The names of the new officers elected at the annual meeting will be printed in "Good Roads" for February 12, and it is proposed to print in a later issue an article giving the entire list of officers and the program of the convention.

An Official Statement Regarding the Pittsburgh Convention

The Executive Committee of the American Road Builders' Association, consisting of First Vice President A. W. Dean, Past President Nelson P. Lewis and Secretary E. L. Powers, has prepared and sent out the following statement:

> It having been claimed and statements having been quite generally circulated to the effect that the American Road Builders' Association in deciding to hold its annual convention for 1916 at Pittsburgh on February 28 has violated an agreement made with the American Highway Association in connection with the Pan-American Road Congress held by the two associations at Oakland beginning September 13, 1915, and has not dealt fairly with those who contributed to that congress as donor or temporary members, the Executive Committee of the American Road Builders' Association makes the following statement:
>
> Owing to the many repeated requests from friends of both the American Road Builders' Association and the American Highway Association, it was finally decided to hold a joint meeting of the two organizations. This meeting was held at Oakland, Cal., in September last, under the name of the Pan-American Road Congress. To provide for the expense incident to the holding of the congress, manufacturers and others interested were solicited for donor and temporary memberships; and in doing so, the Executive Committee of the joint meeting stated that no other meeting of either association would be held during that year. No other statement was ever authorized by the Executive Committee showing any obligation on the part of either association to refrain from holding a convention of its own or participating in any other meeting after the expiration of the year 1915. The copy of resolution enclosed herewith was unanimously passed by the Executive Committee of the Pan-American Road Congress at a meeting held November 27.
>
> Under the circumstances we are convinced that the American Road Builders' Association has not violated either the letter or the spirit of any agreement through the changing of the date of its annual meeting from December, 1916, to February 28 of the same calendar year. This change in the time of the annual meeting from a date after the close of the working season to one before the commencement of the working season when many new highway officials have just assumed office has been contemplated for some years, and the directors of the American Road Builders' Association after very careful consideration decided that this was an opportune time to make the change.
>
> The Convention and Show to be held in Pittsburgh, February 28 to March 3, gives every promise of being one of the most successful ever held under the auspices of this Association.

The resolution referred to in the second paragraph of the foregoing was as follows:

> WHEREAS, information and communications have reached the members of this committee to the effect that this committee, or its treasurer and chairman of its sub-committee on finance, had solicited funds for the Pan-American Road Congress with the understanding that neither the American Road Builders' Association nor the American Highway Association would hold another convention within twelve months after the date of the Pan-American Road Congress (September 13-17, 1915), and
>
> WHEREAS, the members of this committee do not know nor have they known of any agreement by the two associations or by their authorized representatives that neither association would, in view of the holding of the Pan-American Road Congress, September 13-17, 1915, hold a convention before September 13, 1916, but have recognized and do now recognize the existence of an agreement that neither association will hold a convention during this year, 1915,
>
> THEREFORE BE IT RESOLVED that, after examination of the correspondence of the Treasurer of this committee, we do not consider that in his solicitation of contributions toward the Pan-American Road Congress he has exceeded his instructions or in any way bound either the American Road Builders' Association or the American Highway Association not to hold a convention after January, 1916, and
>
> BE IT FURTHER RESOLVED that we do not consider, in view of the facts mentioned, and others incidental thereto, that this committee has in any way bound either the American Road Builders' Association or the American Highway Association not to hold one or more conventions after January 1, 1916, though we do consider each association bound in good faith not to hold or as an association to participate in any convention during the calendar year 1915.

Wm. H. Connell Reappointed Chief of the Philadelphia Bureau of Highways and Street Cleaning

Wm. H. Connell, for several years a member of the Board of Directors of the A. R. B. A., has been reappointed Chief of the Bureau of Highways and Street Cleaning of Philadelphia, Pa., by Mayor Smith.

Mr. Connell was appointed by the Blankenburg administration, the recent retirement of which has been followed by a large number of changes in the various departments of the city. For this reason Mr. Connell's retention is a marked recognition of his efficiency.

Mr. Connell went to Philadelphia from New York City. His reappointment by Mayor Smith was announced after the Mayor had inspected many Philadelphia streets and roads improved during Mr. Connell's administration.

Before going to Philadelphia, Mr. Connell was Assistant Commissioner of Public Works in the Borough of the Bronx, New York City, of which city he is a native. Besides being a member of the A. R. B. A., Mr. Connell is an associate member of the American Society of Civil Engineers and belongs to many other engineering societies.

REPORTS

DISTRICT OF COLUMBIA, ENGINEER DEPARTMENT; Report of Operations for the Year Ending June 30, 1915. Paper; 6x9 ins., 314 pp.

This report includes an extract from the report of the Commissioners of the District to the Senate and House of Representatives and a complete report of the Engineer Department. Included in the latter are the reports of the Engineer of Highways, the Superintendent of Street Cleaning, the Inspector of Asphalts and Cements, the Surveyor, the Superintendent of Trees and Parking, and the officers in charge of various other divisions of the Engineer Department. Included in the report of the Engineer of Highways are the reports of the Superintendent of Streets, the Superintendent of Suburban Roads and the Engineer of Bridges.

NEW YORK, N. Y., BOROUGH OF MANHATTAN; Report of the President for the Year Ending December 31, 1914. Paper; 6¾x9¾ ins., 330 +xvi pp.; illustrated.

This report is divided into three parts—the first comprising the general report of the Borough President, the second the report of the Department of Public Works and the third the report of the Bureau of Buildings. Included in the report of the Department of Public Works are the reports of the Bureau of Highways, the Bureau of Sewers, the Bureau of Design and Survey and the Bureau of Public Buildings and Offices. The report of the Bureau of Highways occupies 95 pages and is profusely illustrated with views of streets in service and under construction, and illustrations of the municipal asphalt plant and its equipment. There are also several diagrams and charts.

BOOK NOTICE

CITY PLANNING, by Charles Mulford Robinson. Cloth; 8vo, xiv + 344 pp.; illustrated. G. P. Putnam's Sons, 2 West 45th St., New York, N. Y. $2.50.

This volume, the full title of which is "City Planning, With Special Reference to the Planning of Streets and Lots," is, according to the announcement on the title page, "a reissue, revised, with much additional material, of the work originally published under the title of 'The Width and Arrangement of Streets.'" Besides the introduction, the book contains 19 chapters, divided into four divisions, the first of these dealing with standardization in street platting, the second with functional street platting, the third with city planning legislation and the fourth containing the author's conclusions. The chapter headings included in the division of "Standardization in Street Platting" are as follows: "Rectangular Street Platting; Its Origin and Justification;" "The Standardizing of Streets;" "Economic Defects of Standardization;" 'Social Deficiencies of Standardization." Those in the division dealing with "Functional Street Platting" are: "The Need, The Theory and Its Rationale;" "The Street System's Natural Divisions;" "The Location of Main Traffic Streets;" "The Width and Development of Main Traffic Streets;" "The Platting of Minor Residence Streets for High-Class Districts;" "The Platting of Minor Streets for Humble Homes;" "Lot Platting for Humble Homes and Factory Removal;" Public Reservations Other Than the Streets;" "The Development of Residential Streets." The chapter headings under the division dealing with "City Planning Legislation" are: "Centralized Control;" "Control Beyond City Boundaries;" "Excess Condemnation;" "Various Methods of Street Widening;" "The Zoning or Districting System." The concluding chapter is headed "The Test of City Planning—Limitations and Benefits." The illustrations consist of halftones and line drawings comprising views showing actual examples of city planning, maps and diagrams of street layouts, and other views of city planning in American and foreign cities.

NEW PUBLICATION

SURFACE OILING OF EARTH ROADS, prepared by B. H. Piepmeier, Maintenance Engineer, Illinois State Highway Department; Bulletin No. 11 of the Department.—Paper; 6x9 ins., 28 pp. and covers; illustrated.

This bulletin has been prepared for distribution, according to Chief State Highway Engineer W. W. Marr of the Illinois State Highway Department, to meet the increased demand for information on the subject of oiling earth roads, the idea being to give a general outline of the subject, together with suggestions as to the best methods of oiling and maintaining such roads. The bulletin takes up the selection of roads for oiling, the preparation of the road surface and methods of applying the oil. There are included, also, discussions of the quality of oil and the cost of the work. The illustrations consist of half-tone reproductions of photographs showing earth roads before and after oiling, methods of preparing the road surface for oiling and various oiling machines in operation. Copies of the bulletin may be obtained, free, by applying to the State Highway Department at Springfield.

PERSONAL NOTES

Robert C. Wheeler has been appointed City Engineer of Summit, N. J.

Archie B. Cook has been reappointed City Engineer of Santa Barbara, Cal.

S. W. Mitchell has been appointed County Engineer of Tulsa County, Okla.

Albert Wilber, former City Engineer of Herkimer, N. Y., died recently at Syracuse, N. Y.

Lorin A. Hendley was recently reelected President of the Board of Public Works at Los Angeles, Cal.

K. B. Ward, a consulting engineer of Columbus, Ohio, has been appointed City Manager of Sandusky, O.

John J. Bracken, a civil engineer of Newark, N. J., has been appointed Town Engineer of Harrison, N. J.

H. C. Hanson has been reappointed Superintendent of Construction of Roads and Bridges in Lake County, Minn.

S. Foster Jacques, Assistant City Engineer of Binghamton, N. Y., died recently from injuries received in a motorcycle accident.

F. E. Walters, Deputy County Superintendent of Highways of Summit County, O., has been promoted to the superintendency.

James K. Wilkes, at one time Chief Engineer of the Department of Public Works, New Rochelle, N. Y., died recently in that city.

Work on the Birmingham-Montgomery Highway in Alabama has been suspended on account of an injunction against paying out of $50,000 road warrants previously voted and sold.

Wheeler County, Ga., has Employed a Road Superintendent who, with a gang of convicts, has started the construction of a modern road system. At present there are ten convicts in the road gang, but the number will be increased shortly.

LETTERS TO THE EDITOR

Cost of Street Cleaning in Cleveland, Ohio

Editor, "Good Roads":

I notice in your last issue, January 1, 1916, you have an item giving the cost of street cleaning in Cleveland, Ohio, for the year 1914 as slightly over $500,000. While the figures are correct insofar as the appropriation to the department is concerned, you failed to mention that the amount covered the combined work of street cleaning (560 miles) and the collection of ashes and rubbish from 151,000 householders, also the cleaning of 15,000 catch basins. Will you kindly correct this in your next issue as the article as it appeared is misleading and to my discredit?

GUS. H. HANNA,
Formerly Superintendent of Street Cleaning.
Cleveland, Ohio.

[The item referred to by Mr. Hanna is a "news note" printed on page 23 of "Good Roads" for Jan. 1, 1916. The exact statement made was as follows: "Street cleaning in the city of Cleveland, Ohio, during 1914, cost slightly over $500,000, according to the annual report of Gus. H. Hanna, Superintendent of Street Cleaning of that city." The words "street cleaning," as used in the item, referred to all the work of the street cleaning department, which, in Cleveland, as in many other cities, includes the collection of ashes and rubbish and other work. Since, however, there were also given in the item the street areas cleaned by various methods during the year and the unit costs thereof, it does not seem to us that the item, as a whole, is either misleading or to the discredit of Mr. Hanna, who, we understand, has served the city of Cleveland both faithfully and efficiently for a long time. Further data on street cleaning work in Cleveland are given in this issue in a resume of a paper presented by Mr. Hanna at the recent road convention at Worcester, Mass.—Ed.]

Brick Used to Resurface Worn-Out Macadam in Carlisle, Pennsylvania

Editor, "Good Roads":

Noting an article in your issue of January 1 on the paving of streets in Cleveland with vitrified brick on a resurface macadam foundation, and inasmuch as this article seemed to convey the impression that Cleveland was the pioneer city to adopt this method, I think it only proper that your columns give space to the following facts:

That Carlisle, Pa., started this construction in 1909 under charge of the writer, which was noted by articles and photographs in "Engineering & Contracting" during 1910, and since that time has been successfully carried out by the writer's successor and present incumbent, John C. Hiteshew, City Engineer of Carlisle, and which he ably described in the "Municipal Journal" of December 30, 1915. As these first streets have stood seven years of medium heavy traffic and are still in excellent shape, I think it only due to the smaller community to have the credit acknowledged.

C. A. BINGHAM,
General Manager,
Town of Norwood, Mass.
Norwood, Mass.

[We are very glad indeed to give space to Mr. Bingham's letter calling attention to the work in Carlisle, Pa. At the same time, the article referred to by him—"Worn-Out Macadam Road in Cleveland, Ohio, Resurfaced with Brick," printed on page 8 of the issue of January 1—was certainly not intended to convey the impression that Cleveland was the first city to adopt this method of construction. On the other hand, it was printed as an illustration of the feasibility of resurfacing old macadam roads with brick. The first sentence in the article and practically the only one which does not refer to the method of construction itself rather than to the economic phase of the matter is as follows: "The feasibility of utilizing worn-out macadam as a base for brick pavement is illustrated by a residence street in Cleveland, Ohio, where a pavement of this type has been in use for nearly a year and a half." The inference from this sentence, it seems to us, would be that the construction dealt with was cited as an example only.—Ed.]

COMING MEETINGS

February 7—Oregon Society of Engineers—Annual meeting, Portland, Ore. Secretary, H. M. Morse, Portland.

February 8-11—Second Conference on Road Construction for County Road Superintendents and Engineers—Toronto, Ont. W. A. McLean, Deputy Minister of Highways, Province of Ontario, Toronto, Ont.

February 9-11—Ohio Engineering Society—Annual convention, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 10-12—Minnesota Surveyors' and Engineers' Society—Annual meeting, St. Paul, Minn. Secretary, George H. Herrold, St. Paul.

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 14-17—Connecticut Society of Civil Engineers—Annual meeting, New Haven, Conn. Secretary, J. Frederick Jackson, Chamber of Commerce Building, New Haven, Conn.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 16-18—Iowa Engineering Society.—Annual meeting, Des Moines, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal, P. Q., Canada.

EQUIPMENT — TRADE — MATERIALS

One Use for a Street Flusher

One of the uses besides flushing pavements to which flushers can be put is shown in the accompanying illustration.

The work—the spraying of a tree—was done at Boone, Ia. The liquid to be sprayed was placed in the tank of the pressure flusher and discharged through a hose as shown. The machine used was a Studebaker Uniform Pressure Street Flusher. The machine consists of a 750-gal. tank mounted on a truck and provided with a gasoline engine and pump to provide pressure for the discharge. When used for street flushing, the water is discharged from the nozzles, which can be seen in the illustration, just in front of the rear wheels.

STUDEBAKER UNIFORM PRESSURE STREET FLUSHER USED FOR TREE SPRAYING.

Although, of course, used primarily for street flushing, the machine can be employed as in the present case or can be used for watering trees, flowers, shrubbery or grass in parks or along streets where hydrants are not conveniently located.

New Two-Way, Side-Dump Motor Truck Body

A new motor truck body that can be dumped to either side is shown in the accompanying illustrations. The construction of the body and the manner in which it is attached to the truck chassis may be seen by reference to both Fig. 1 and Fig. 2. The operating mechanism is lettered in Fig. 1.

The body A (see Fig. 1) is held upright by a catch B at the rear and a similar catch in front and by the arm H at the side and a similar contrivance at the other side. At the ends and center of the body are semi-circular frames which roll upon the three rails D, D, D, shown in Fig. 1. Each of the three rails slopes from the center line of the chassis toward each side and terminates in a hook at each end, as shown. To dump the body, the handle G is raised, thus releasing the stop C and allowing the supporting arm H to be pulled outward and downward and hang from the hinge K. The operator then moves the lever E to either side, thus releasing the catch B and also the similar catch in front, previously referred to, the two being connected by a longitudinal rod. One of the handles F is then pulled out and the body rolled to the side. The distance through which the body will revolve is governed by the restraining chains shown under the body in Fig. 2.

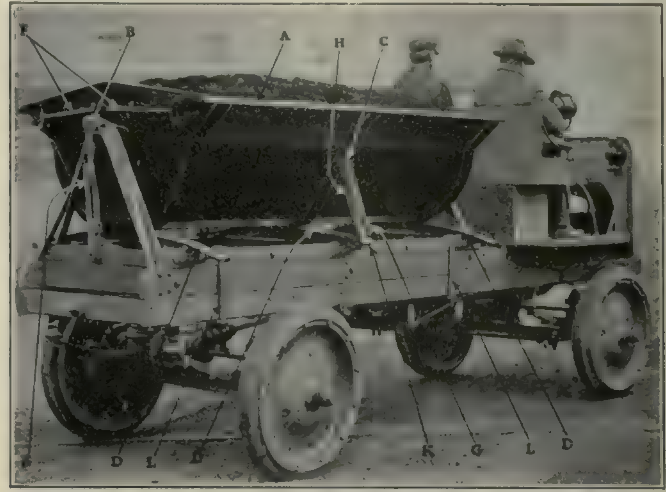


FIGURE 1—TWO-WAY, SIDE-DUMP BODY MADE BY THE LEE LOADER CO. MOUNTED ON A JEFFERY QUAD—SEE TEXT FOR EXPLANATION OF LETTERING.

It is stated that in a series of tests at the Jeffery factory it was proved that the average driver could leave his seat, dump the load, replace and secure the body and return to his seat in 30 seconds.

The body is built by the Lee Loader Co., Chicago, Ill., and was designed especially for use on the Jeffery "Quad," manufactured by the Thomas B. Jeffery Co., Kenosha, Wis. The chassis shown in the illustration is a "Quad."

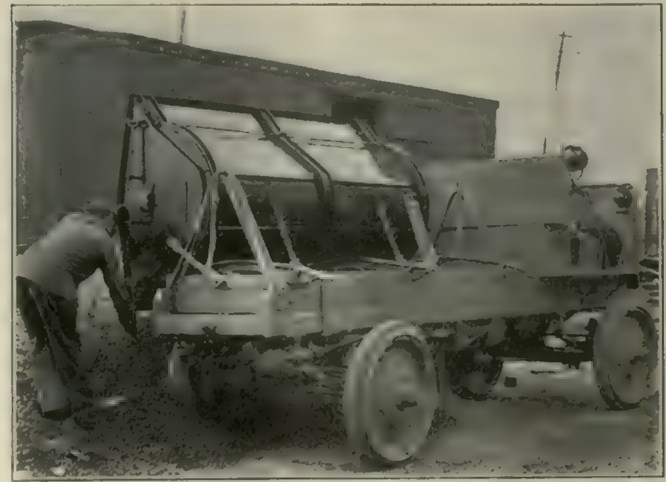
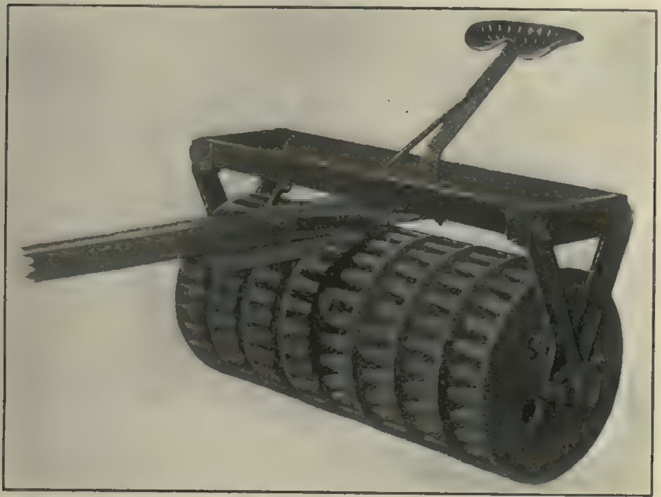


FIG. 2 JEFFERY QUAD WITH TWO-WAY, SIDE-DUMP BODY IN DUMPING POSITION.

New Tamper Roller

A tamper roller designed especially for use in the construction of earth and gravel roads is shown in the accompanying illustration.

The machine consists essentially of a series of toothed rolls, mounted upon a 3-in. steel shaft, upon which each roll turns independently. There are eight of these sections, arranged in two sets, the teeth on those in each set pointing toward the center of the machine. Without weights, the roller weighs 2,500 lbs. and can be drawn by two horses.



TAMPER ROLLER MADE BY THE BEACH MFG. CO.

It is stated that the machine when operated on 6 ins. of loose gravel will penetrate to a depth of about 4 ins., compacting the lower 2 ins. first and then gradually working to the surface as the material is tamped.

The machine is made by the Beach Mfg. Co., Charlotte, Mich.

Good Roads Campaign by the Garford Motor Truck Company

Early last year the sales department of the Garford Motor Truck Co. inaugurated a good roads campaign, after urging upon others in the same line the importance of such work to promote sales, and suggesting that a campaign be undertaken by the industry. In a letter recently sent out by the Garford company to officials of motor car and motor truck manufacturers, cooperation in an educational campaign is again suggested and some interesting statistics relative to the condition of the roads of the country are included.

The statistics referred to were obtained from the replies to inquiries sent out by the company to automobile dealers, the purpose being to show the handicap under which motor truck manufacturers' distributors work because of the unsuitability of roads for motor traffic.

According to the figures given by the Garford company, 2,565 out of 3,440 dealers in motor cars and motor trucks throughout the country reported the condition of the public roads in their territories as "bad to fair," the latter only in dry weather. That road conditions in their territories make the satisfactory and economical use of the motor car and motor truck impossible during part of the year was reported by 1,647 dealers. The portion of the year during which such conditions obtain was given by 906 dealers as from 25 to 50 per cent., by 574 as from 50 to 75 per cent. and by 167 as from 75 to 100 per cent. It was believed by 2,045 dealers that permanently improved roads in their territories would materially increase the possibility of selling motor cars and trucks. Of these, 1,136 stated that they believed the increase would range from 25 to 50 per cent., 642 from 50 to 75 per cent. and 267 from 75 to 100 per cent.

Tests of "National" Slag Concrete

The report printed below is the final report on comparative tests of "National" slag concrete and Palisade trap rock concrete conducted by the Department of Civil Engineering at Columbia University, New York, N. Y. "National" slag is a material produced by the National Slag Co., Newark, N. J.

Final Report of Comparative Tests of National Slag and Palisade Trap Rock

The Palisade trap rock was separated into ¾-in., ½-in., ¼-in. and "dust" and was artificially combined so that the grading was identical to that of the National slag, which was used as received.

The sand used was "Cow Bay," a typical Long Island sand, and the cement was a mixture of three brands of Portland cement, as approved by the New York Building Bureaus, viz., Atlas, Dragon and Kane.

The mixture of the concrete was in all cases 1:2:4 by volume, and was mixed in a Blystone batch mixer. In making up the complement of stone for each batch, proportional amounts of each aggregate were carefully measured by weight. It was thought that this procedure would insure greater uniformity in results.

The preparation and test of the specimens were witnessed by George E. Strehan, H. S. Sylvester, E. Wilkinson, T. H. Heatley, A. C. Siebert of Manhattan, Brooklyn, Bronx and Queens Building Bureaus; W. J. McDermott, Superintendent, Richmond Building Bureau; E. J. Elkind of the Public Service Commission, First District, New York, N. Y.; L. W. Walter and C. H. Splitstone of the Erie Railroad, and C. S. Chard of the Public Utility Commission of New Jersey.

TABLE OF RESULTS OF ULTIMATE STRENGTH IN LBS. PER SQ. IN. OF COMPRESSION TEST, 8 BY 16-IN. CYLINDERS

Averages given in the following table are the results of testing four specimens of both types of concrete at each period

	28 days	3 months	6 months	12 months
National slag concrete	2,465	3,496	3,567	4,187
Palisade trap rock concrete	1,975	2,961	3,053	3,537
Higher compressive strength of slag concrete	490	535	514	650
Percentage higher compressive strength of slag concrete	24.8	18.0	16.9	18.4

Report of Determination of Modulus of Elasticity of National Slag and Palisade Trap Rock Concrete Three Months Old

The specimens tested were three National slag and three Palisade trap rock concrete, 8- by 16-in. cylinders. An average value in each case was taken up to a unit load of 650 lbs. per sq. in. with the following results:

	Mod. of Elas.
National slag	4,126,000
Palisade trap rock concrete	4,036,000

The average weight of National slag concrete was 140 lbs. per cu. ft.

The average weight of Palisade trap concrete was 151 lbs. per cu. ft.

National slag weighed 80 lbs. per cu. ft.

Palisade trap weighed 100 lbs. per cu. ft.

Respectfully submitted,
(Signed). Frederick Miller,
Department of Civil Engineering,
Columbia, University,
New York, N. Y.

Jan. 12, 1916.

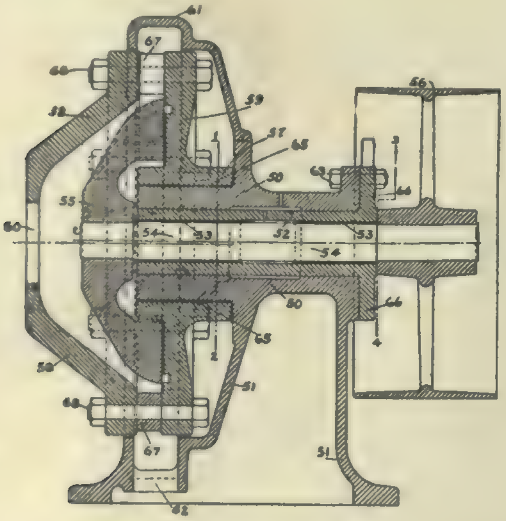
TRADE NOTES

The American Cement Machine Co., Inc., Keokuk, Ia., has issued quite an elaborate booklet of specifications of its various types of concrete mixers and pavers. It contains 14 pages and is illustrated with many halftones and a reproduction of a blue print giving the general dimensions of the "Boss" mixers.

The Association of American Portland Cement Manufacturers will shortly move its headquarters from Philadelphia, Pa., to Chicago, Ill., where offices have been opened in the Conway Building. The association recently opened offices in the Rialto Building, San Francisco, Cal., and will also open offices in New York, N. Y,

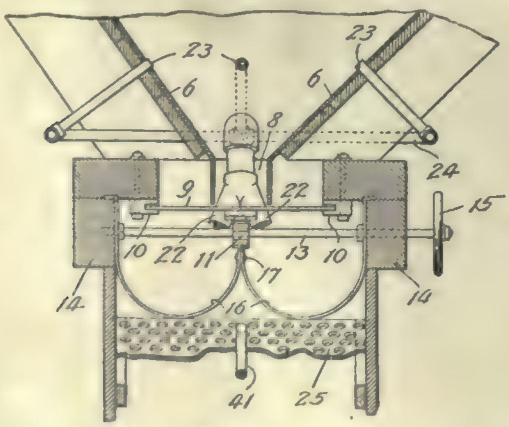
RECENT PATENTS

The following list contains the numbers of the pricipal patents relating to roads and pavements and to machinery used in their construction or maintenance which have recently been issued, together with the names and addresses of the patentees, dates of filing, serial numbers, etc. In some cases the principal drawing has also been reproduced. Printed copies of patents listed may be obtained for 5 cts. each by application to the Commissioner of Patents, Patent Office, Washington, D. C.:



1,164,762. ROCK CRUSHER. Charles G. Simonds and Albert E. Smith, Milwaukee, Wis. Filed Aug. 18, 1910. Serial No. 577,841. (Cl. 83-10.)

1,165,044. ROAD BOX COVER. Clarence E. Tyler, Newark, N. J., assignor to S. E. T. Valve & Hydrant Co., New York, N. Y. Original application filed Apr. 28, 1913. Serial No. 764,145. Divided and this application filed Mar. 12, 1914. Serial No. 824,306. (Cl. 94-7.)



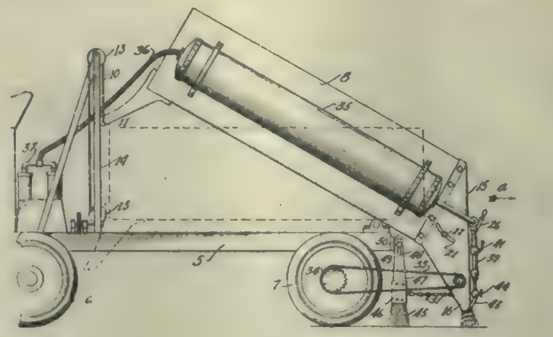
1,165,077. GRAVEL WASHING APPARATUS. Louis E. Dierks and Henry B. Sauerman, Chicago, Ill. Filed May 15, 1915. Serial No. 28,354. (Cl. 83-59.)

1,165,137. DOUBLE WALLED STRAINER FOR CULVERTS, DRAINAGE CASINGS, ETC., AND CONNECTING MEANS THEREFOR. Andrew Smith, San Mateo, Cal. Filed July 29, 1913. Serial No. 781,820. (Cl. 61-9.)

1,168,585. COMBINED ROAD GRADER AND DRAG. John W. Woolery, Oxford Township, Johnson County, Kansas. Filed June 15, 1912. Serial No. 703,958. (Cl. 37-7.)

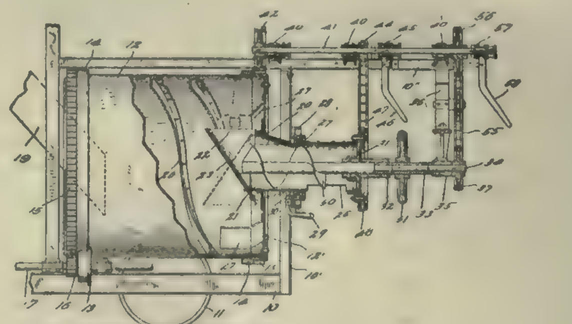
1,168,689. DUMP BOX FOR DUMP WAGONS. Walter A. Underhill, Auburn, N. Y. Original application filed Jan. 23, 1912, Serial No. 672,879. Divided and this application filed Dec. 30, 1914. Serial No. 879,707. (Cl. 21-20.)

1,168,723. ROAD GRADER. Elie B. Harris, Eustace, Tex., assignor of one-half to S. L. Reese, Corsicana, Tex. Filed Feb. 7, 1914. Serial No. 817,160. (Cl. 37-5.)



1,165,331. ROAD SANDING APPARATUS. Granville H. Gray, Los Angeles, Cal. Filed Mar. 9, 1914. Serial No. 823,375. (Cl. 111-34.)

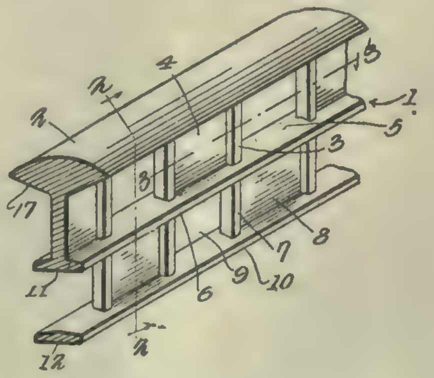
1,166,897. LOADING MACHINE. David F. Geiger, Fargo, N. D., assignor of one-third to E. C. Wingire, Fargo, N. D. Filed May 5, 1913. Serial No. 765,452. (Cl. 56-61.)



1,167,402. CONCRETE MIXER. Carl F. Hetherington, Indianapolis, Ind. Filed Feb. 15, 1915. Serial No. 8,176. (Cl. 83-73.)

1,167,494. HIGHWAY TRACK. Frank J. Hardecker, New York, N. Y. Filed Apr. 20, 1915. Serial No. 22,539. (Cl. 104-178.)

1,167,495. HIGHWAY TRACK. Frank J. Hardecker, New York, N. Y. Filed Oct. 15, 1915. Serial No. 55,948. (Cl. 104-178.)



1,167,585. CONCRETE CURB ARMOR. Charles A. Miller and Claude K. Doak, San Francisco, Cal. Filed July 26, 1915. Serial No. 41,918. (Cl. 94-2.)

1,168,768. PROCESS FOR MANUFACTURING COMPRESSED ASPHALT BLOCKS. George B. Upham, Boston, Mass. Filed July 5, 1910. Serial No. 570,266. (Cl. 18-48.)

1,169,464. CONCRETE CURBING FORM. Henry D. Cornelius, Indianapolis, Ind. Filed May 7, 1915. Serial No. 26,624. (Cl. 25-118.)

1,169,619. ROAD MACHINE. Ambrose Conkle, Luray, Mo. Filed Nov. 28, 1908. Serial No. 464,824. (Cl. 37-5.)

1,169,689. DRAINAGE CASING FOR CULVERTS, DRAIN TILING, WELLS, ETC. Andrew Smith, San Mateo, Cal. Filed July 28, 1914. Serial No. 852,655. (Cl. 61-9.)

GOOD ROADS

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DISCUSSION OF HIGHWAY CONSTRUCTION AT THE SPECIAL MEETINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

An account of the public meetings held by the American Society of Civil Engineers on January 21 for discussion on the progress report of the society's Special Committee on Materials for Road Construction and on Standards for Their Test and Use was printed in "Good Roads" for January 29, the account, including the text of the committee's progress report.

The meetings, which have been held at the close of the annual meetings of the society, have been well attended by members of the society and by other engineers, the meetings being open to all who are interested. As no time is taken up by formal papers, there have been at all meetings very general discussions which have not only been of considerable assistance to the committee in its work but have also been of much value to those able to attend. The meetings of this year were of perhaps unusual interest because of the discussion of several matters which have occupied the attention of highway engineers during the past year. One of these was the matter of the sand cushion for brick pavements. This subject is covered at length elsewhere in this issue, but should be noted briefly here.

The only recommendation as to the sand cushion contained in the committee's report was that the depth of the sand cushion be reduced. It was held that the thickness of sand cushion as often used is excessive and that if the variation in the depth of the brick did not exceed ⅛ in., and if the surface of the concrete foundation were sufficiently even, a cushion course of 1 in. or even ¾ in. in depth would be sufficient. The discussion on this phase of the report indicated a very general agreement with the recommendation of the committee that the depth of the sand cushion be reduced. There was also evident a very decided tendency to favor the substitution of a cement-sand bed for the sand cushion.

Another point in connection with brick paving upon which there seemed to be quite general agreement was that there is need of the further development of the bituminous filler.

In the discussion of stone block pavements considerable attention was given to the tests to be specified. The point upon which there was perhaps the most general agreement was that the test for crushing strength is not necessary, as the majority of granites ordinarily used for paving are sufficiently hard. The point was also made that uniformity in the blocks in a given pavement is of great importance. There was also a very general agreement that the blocks in old granite pavements can advantageously be recut and relaid.

Many interesting points were brought up in the discussion, not only of brick and of stone block pavement, but also of wood block pavements and concrete pavements. There was an especially spirited discussion on the use of expansion joints in concrete pavements. On this subject opinion seemed to be about equally divided, with the weight of authority possibly somewhat in favor of the use of joints.

Pennsylvania Negotiating for the Purchase of Toll Roads

Negotiations for the freeing of toll roads in the eastern part of Pennsylvania have been started by State Highway Commissioner Cunningham, who has asked the company controlling the Lancaster Pike to submit a price for its property.

The portion of the pike which the department desires to purchase extends from the Philadelphia city line at Overbrook, to Paoli. The pike is owned by the Lancaster Avenue Improvement Co., Philadelphia.

Commissioner Cunningham has also announced that he would open negotiations with the four companies controlling the Old Bethlehem Pike from Philadelphia to Allentown, with a view to the ultimate purchase of this highway.

Road Work in New York State

The New York State Highway Department has apportioned funds for 1916 road work among a number of the counties of the state. The amounts and mileages are as follows:

Allegany County, 107.15 miles, $29,073; Cattaraugus County, 59.51 miles, $47,066; Chautauqua County, 73.78 miles $15,390; Erie County, 279 miles, $112,765; Genesee County, 48.59 miles, $13,628; Niagara County, 129.07 miles, $52,747; Orleans County, 91.65 miles, $22,151; Wyoming County, 45.92 miles, $13,941.

Annual Meeting of the American Road Builders' Association

The annual meeting of the American Road Builders' Association and election of officers for the year 1916, were held at the Automobile Club of America, New York, N. Y., on the afternoon of Friday, February 4. The meeting of the association was preceded by a meeting of the Board of Directors at 2:00 p. m.

The meeting of the association was called to order at about three o'clock. After the reading of the minutes of the previous meeting, tellers were appointed to canvass the ballots received for officers and the reports of the Board of Directors, the Secretary and the Treasurer were received. After the completion of the routine business of the meeting, adjournment was taken late in the afternoon.

At about half past six dinner was served in the dining room of the Automobile Club to over seventy members and guests of the A. R. B. A. After coffee and cigars had been passed, George W. Tillson, the outgoing President, called the meeting to order and spoke briefly. He referred to the Oakland meeting in September of last year, and said that while it had been more or less of a disappointment in respect to attendance those who were fortunate enough to make the trip were amply repaid for their time and trouble by the roads and road work which they were enabled to see. He dwelt at some length on the activity in the West and the remarkable progress being made there. He paid especial attention to the Columbia River Highway and other roads in Oregon, Washington and California.

At the close of his remarks, Mr. Tillson called upon Nelson P. Lewis of the Executive Committee. Mr. Lewis said that at the meeting of the directors in the afternoon it had been suggested that he present at the dinner a statement relative to the decision of the A. R. B. A. to hold its convention at Pittsburgh. In accordance with that suggestion, Mr. Lewis then reviewed at length the circumstances leading up to the holding of the joint convention at Oakland and the action which had been taken since that time by the American Road Builders' Association, the American Highway Association and the American Association of State Highway Officials relative to the decision of the Road Builders to hold a congress this month. Mr. Lewis confined himself principally to the official records, reading resolutions which had been passed by the various bodies, and the correspondence of the American Road Builders' Association relative thereto.

At the close of Mr. Lewis' remarks, Mr. Tillson read the report of the tellers, who had counted the ballots cast for the annual election of officers. The election resulted as follows: President, Col. E. A. Stevens, Commissioner of Public Roads of New Jersey; First Vice President, Arthur W. Dean, Chief Engineer, Massachusetts Highway Commission; Second Vice President, Austin B. Fletcher, State Highway Engineer of California; Third Vice President, Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Secretary, E. L. Powers, Editor "Good Roads"; Treasurer, W. W. Crosby, Consulting Engineer, Baltimore, Md. Directors for three years: Wm. D. Uhler, Chief Engineer, Pennsylvania State Highway Department; R. A. Meeker, State Highway Engineer of New Jersey; Governor Charles W. Gates of Vermont; R. Keith Compton, Chairman and Consulting Engineer, Paving Commission, Baltimore, Md.; James H. MacDonald, ex-State Highway Commissioner of Connecticut; Frank M. Williams, State Engineer and Surveyor of New York.

Mr. Tillson then introduced Col. E. A. Stevens, the newly elected President. President Stevens' address follows:

Address by Col. E. A. Stevens, President of the A. R. B. A.

The presiding officer of any great society whose object is progress in applied science should, it has been well said, either be one of the leading practitioners of the art or know nothing about it. I can qualify in neither class, possessing just that small amount of knowledge that is highly dangerous in that it leads fools to "step in where angels fear to tread." Nevertheless, the compliment you have paid me, in choosing me as your president for the coming year, seems to lay on me the duty of acknowledging the honor and trying, as best I may, to justify the wisdom of your action by contributing my mite to forwarding the object of our association. I can probably best discharge this duty by directing your attention to one branch of work in which our membership qualifies us specially for useful service.

The missionary work of persuading communities that good roads pay, and of arousing public interest in getting them has been largely done. What remains to be accomplished in this line can and should be left to sister bodies more specially organized with that end in view.

The details of road building, the general principles necessary to secure good work, still need emphasis and must always be the subject of discussion among road builders. New methods will undoubtedly be brought forward to meet the new and ever increasing demands of modern traffic. This discussion, to be of value, must be based on a comparison of results; the latter can be made satisfactorily only by scientifically correct analysis of carefully gathered data. The object of any such analysis must be to show the cost of the service rendered referred to a unit correctly and accurately expressing the value thereof. This involves, if comparative use is to be made of the results, uniform bookkeeping and traffic counting. There is little, if any, agreement as to methods of gathering these data. There are, of course, some jurisdictions where elaborate sets of books have been opened and from which very full reports have been published. I have yet, however, to see one that, to my mind, fully satisfied all the requirements. Mind you, I do not say that there are none; my experience is too small to warrant any such generalization.

Let me outline what impresses me as needful. This impression arises from the perusal of many statements of road accounts and from the information I have sought, or rather used to seek therefrom, but which I regret to say I have never been able to gather.

A satisfactory system of road accounts should show not only the cost of all materials, labor, teams, etc., but the cost of the different kinds of work done, original construction, betterments and repair. There should also be shown the total cost of the service performed, including interest and depreciation charges. These charges should all be made on some generally accepted basis. Each term used should, in every case, have the same meaning. The rules for estimating depreciation, determining the dividing line between repairs proper and betterments should be the same, as should also be the rates of interest.

The service rendered, too, should be ascertained and stated in standard terms. It will naturally be measured by distance, weight and speed. The latter may be hard to incorporate into a unit, but it is none the less necessary to do so if we are to have a true measure of the return. Speed has value and entails increased wear. But the wear is in no sense a proper consideration in fixing our traffic unit. The information wanted is the cost of the service compared with the return. That construction or that system of maintenance is the best which will give the return for the least expense. Our object is cheap and efficient service, not the handicapping of the higher grades of work to make them appear equal to inferior types. In other words, we are not for this purpose seeking the differences in stresses imposed on a road surface, by moving a given load over it at different speeds, but the difference in value of the transportation of the said given load at said speeds. Just as in the market for ocean freights, a steamer can command higher rates per ton than a sailing ship, so the value of moving a ton over a highway at twenty miles an hour exceeds the value of moving it at ten. In saying this I am not decrying in any way the value of an accurate and, I am sorry to say, still lacking knowledge of the stresses in road surfaces. What I want to emphasize is that this knowledge is only a means to enable the designer to better attain his object, the lowering of the cost of transport.

Road bookkeeping is still in its infancy. With our American conditions, we shall for many years continue to resurface, widen and otherwise add to the asset value of roads already built and of many of those yet to be built. These additions are betterments and their inclusion in the repair charge is deceptive. How account is to be kept of them without a regular set of double-entry books is hard to imagine. With such charges removed from the repair account proper, we must deduce the true cost of the service rendered. To the charge for the labor and material used in repair work should be added the proper proportion of overhead charges. It is here that I have met with many and grievous troubles. A division of all overhead charges on the basis of the total cost of work done seems the fairest. This charge should also include something for the use of machinery.

To the repair charge should be added a depreciation and an interest charge. In any large system, the former, as against the whole system, will probably work itself out fairly well year by year, but we want information as to the value of each type and must in each case consider the depreciation as a part of the cost of the service. It needs no argument to prove that the decreased cost of repair on expensive types must be offset by an increased interest charge unless we are trying to fool ourselves. With the resulting total cost of service, we must compare the service rendered. Here our difficulties become serious. Every authority seems to take a different classification of traffic, to arrive at the result by a different system of averages. If we introduce speed as a factor, we shall further complicate an already complicated subject. Yet, it seems to me, we must do this. It seems possible to assign to certain classes of traffic certain average speeds, as is now done in many cases as to weights. This assignment in itself will entail careful study. I feel that with the cooperation of the motor vehicle authorities some designating mark can be placed on registry tags that would indicate the class in which every vehicle shall be counted. This would be of minor value unless the classification is standardized. The value of speed must then be settled, for there is no use in determining it unless we can agree as to what it is worth.

My excuse for inflicting on your patience this too lengthy dissertation is my conviction of the need of a more satisfactory method of accounting to the public for the large sum that must be spent on our highways. Our task as road builders is being performed under many difficulties, not the least, nay the greatest, of which is the lack of confidence of the American people in its civilian employees. This is evidenced in many ways—prohibition of the use of patented types, prescription of minute details of procedure, investigations, etc. Until this lack of confidence is overcome, justice cannot be done the job. After five years of service, I am today one of the senior highway officials, and yet continuity of policy and hence of personnel is essential to full success. With public opinion, such as it is, but one argument will prevail: We Americans, on this, are all of us "from Missouri"; we must be shown.

Only when we can give the exact cost of service, referred to its commercial return, compared with similar data from other communities, will we satisfy the boss, and until we satisfy him our job is not done.

American highway engineering is still emerging from the pioneer stage. We are leaving behind us the rough and ready methods that were needed in the earlier days. We are facing a job many times greater than the Panama Canal. It is none too soon to agree on the true measure by which the value of our work is to be judged. What I urge on you as road builders is to undertake the standardizing of this measure.

The next speaker was Chas. Whiting Baker, Editor of "Engineering News." Mr. Baker spoke briefly, congratulating Col. Stevens and the association upon the election and also touching briefly upon the subject of federal aid and the Shackleford bill recently passed by the House of Representatives. He did not favor federal aid for general road work but did suggest the advisability of the government's building certain roads along the coast to facilitate the movement of troops in case of foreign invasion.

H. M. Swetland, of "The Automobile," followed Mr. Baker. He spoke briefly upon the relation between the automobilists and the road builders and urged that roads be built for automobile traffic and not for horse-drawn traffic and also that the roads be so built as to stand up under speed as well as under weight of traffic. He said that there were three things which must come: the roads must be built with less curvature, they must have surfaces that would stand up under speed and they must be so built that traffic in opposite directions would be entirely separate. He also said that the city of New York needed a north and south elevated roadway for automobiles, with separate tracks for north and south traffic and with ramps to the street level at intervals of about ten blocks. He said that he expected to see it.

The last speaker of the evening was Elmer Thompson, Secretary of the Automobile Club of America. Mr. Thompson expressed the regret of President Hemphill who, because of a previous engagement, was unable to be present, and also spoke briefly of the relations between automobilists and road builders, saying that he believed motorists had a very kindly feeling toward those who built the roads.

James H. MacDonald suggested a rising vote of thanks to the Automobile Club for its hospitality, and the vote was taken. He also moved a vote of thanks to the retiring President, George W. Tillson. This also taken. The meeting then adjourned.

Bond Election in St. Louis County, Missouri

An election will be held in St. Louis County, Mo., February 15 on the question of issuing bonds to the amount of $3,000,000 for the construction of a system of county roads and bridges. There has been an active campaign in favor of the project by an organization of citizens known as the Permanent Road and Bridge Association of St. Louis County, the formation of which was noted in "Good Roads" for November 20. Those in charge of the movement profess to be confident of success.

Arizona Counties Plan Road Work

Considerable road improvement is being planned by several counties of Arizona for the coming season. Gila County has already sold $350,000 worth of bonds for the purpose. An election will be held next month in Cochise County on a proposed bond issue of from $600,000 to $1,200,000. Coconino County will vote on $350,000 bonds in the spring and Graham County is considering the matter of issuing bonds for improving the road from Solomonville and San Carlos.

W. A. McLean Appointed Deputy Minister of Highways of Ontario

W. A. McLean, formerly Chief Engineer of Highways of the Department of Public Works of the Province of Ontario, Canada, who has been a prominent member of the A. R. B. A., serving as President for the year 1914, has been appointed Deputy Minister of Highways of the Province of Ontario.

For some years the Province of Ontario has been active in the improvement of its roads, the first highway improvement act having been passed in 1901. The law was amended in 1907 and in 1912, and last year a new law was passed by which the Highways Branch of the Department of Public Works was enlarged and made a Highway Department with a Deputy Minister in charge under the Minister of Public Works and Highways.

Mr. McLean, as Chief Engineer of Highways, was in charge of the former Highways Branch of the Department of Public Works.

Short Course in Highway Engineering at University of Michigan

The second annual short course in highway engineering at the University of Michigan, Ann Arbor, Mich., will commence on Monday, February 21, and continue until February 25, as has been announced in a previous issue of "Good Roads." The course will be under the direction of the College of Engineering in cooperation with the Michigan Highway Department.

The program covers a wide range of subjects of interest to road builders and consists of papers, discussions and lectures by men well known in this field. The subjects are as follows:

February 21—"Highway Engineering at the University of Michigan," H. E. Riggs, Professor of Civil Engineering; "The Value of Road Improvement," Prof. M. E. Cooley, Dean of Engineering; "The Status of Road Building in Michigan," Frank F. Rogers, Michigan State Highway Commissioner; Illustrated talk on "The Construction and Maintenance of Bituminous Surfaces and Bituminous Pavements," Arthur H. Blanchard, Professor of Highway Engineering, Columbia University, New York City; "The Economic Design of Highways with Reference to Traffic," Prof. Blanchard.

February 22—Classroom work and discussions on "Gravel and Macadam Roads," "Gravel Roads," L. H. Neilsen, District Engineer, Michigan Highway Department; "Surface Treatment of Water Bound Macadam Roads," Will J. Cleary, County Engineer, Berrien County, Mich.; "Brick and Concrete Roads," John J. Cox, Assistant Professor of Civil Engineering; "Bituminous Surface Treatment for Water Bound Macadam Roads," Charles S. Reeve, Chief Chemist, U. S. Office of Public Roads and Rural Engineering.

February 23—Classroom work and discussions on "Earth and Sand Clay Roads;" "Some Field and Laboratory Investigations into Materials for Sand-Clay Construction in Michigan," Prof. Cox; "Some Sand-Clay Roads in Dickinson County," G. V. Carpenter, County Road Engineer, Dickinson County, Mich.; "Road Construction Through Timber Lands;" J. A. Broad, County Road Engineer, Luce County, Mich.; "Road Machinery," L. C. Smith, Deputy Highway Commissioner, Michigan Highway Commission; "The Maintenance of Earth Roads," W. S. Gearhart, State Highway Engineer of Kansas.

February 24—Classroom work and discussions on "Surveys, Plans and Record Drawings;" "Road Plans and Record Drawings," H. L. Brightman, Chief Draftsman, Michigan Highway Department; "The Design and Construction of Highway Bridges in Michigan," C. V. Dewart, Bridge Engineer, Michigan Highway Department; "Loadings for Highway Bridges," L. M. Gram, Professor of Structural Engineering; "Specifications and Contracts," H. K. Vedder, Professor of Civil Engineering, Michigan Agricultural College; "The Experience of Maine with Various Types of Road Surfaces Under Various Kinds and Intensities of Traffic," Paul D. Sargent, Chief Engineer, Maine Highway Commission.

February 25—Report of highway commissioners and experience meeting in charge of State Highway Commissioner F. F. Rogers; "The Duty of the County Road Commissioners," William Kelly, Chairman, County Road Commission, Dickinson County, Mich.; "Road Maintenance," Commissioner Rogers; "The Highway Engineer as a Public Servant," Ira O. Baker, Professor of Civil Engineering, University of Illinois.

The sessions will conclude with an informal dinner on the evening of Friday, February 25.

Course for Tennessee County Engineers

The Engineering Department of the University of Tennessee will conduct a correspondence course for county engineers, under the direction of Prof. Charles E. Ferris. The course will consist of twenty lessons, prepared by Prof. Fergus and will include among other subjects, the design of slabs and beams for concrete bridges.

COMING MEETINGS

February 12-19—Ninth Chicago Cement Show.—Chicago, Ill. Secretary, R. F. Hall, 208 South LaSalle Street, Chicago, Ill.

February 14-17—American Concrete Institute.—Annual convention, Chicago, Ill. Secretary, John M. Goodell, 1418 Walnut St., Philadelphia, Pa.

February 14-17—Connecticut Society of Civil Engineers—Annual meeting, New Haven, Conn. Secretary, J. Frederick Jackson, Chamber of Commerce Building, New Haven, Conn.

February 15-18—National Conference on Concrete Road Building—Second National conference, Chicago, Ill. Secretary of Advisory Committee, J. P. Beck, 208 South La Salle St., Chicago.

February 16-18—Iowa Engineering Society—Annual meeting, Des Moines, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 9—Vermont Society of Engineers—Annual meeting, Hotel Vermont, Burlington, Vt. Secretary, George A. Reed, Montpelier, Vt.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

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Proposed Changes in the New York Highway Law

As a result of the protest made by Mayor Mitchel of New York City against the manner in which state highway funds have been distributed, there has been introduced in the State Senate a measure for the general amendment of the present highway law. Mayor Mitchel's action, an account of which was printed in "Good Roads" for February 5, was brought about by the investigation of city affairs by the Brown Committee.

The principal features of the bill, which was introduced by Senator Argetsinger, are the reorganization of the highway department, the changes made in the control of work and the provisions for paying for maintenance. The head of the department under the proposed bill is a state highway commissioner, appointed by the governor with the advice and consent of the Senate for a term of five years. The commissioner is empowered to appoint one assistant commissioner "for temporary service," one assistant commissioner "for permanent service," six deputy commissioners "for temporary service," a secretary and a purchasing agent. He may also appoint an advisory commissioner to serve during such period as may be advisable to "assist the commissioner in organizing an effective and efficient system of maintenance and to perform such other duties as in his judgment may be required." It is understood that the force appointed "for temporary service" is intended to take care of construction work and is to be abolished when that work is completed, while the force appointed for "permanent service" is the force which will have charge of maintenance. The present division engineers, of which there are nine, are replaced by the six deputy commissioners appointed "for temporary service."

The present law providing for the appointment of district superintendents is amended to provide for the division of the state into ten districts, in each of which a supervisor of highways is to be appointed, this official to have charge of the maintenance of state and county highways and the maintenance and construction of town highways.

The most radical changes proposed by the new bill are those in reference to the maintenance and repair of state and county highways. Under the present law the maintenance of improved state and county highways is under the direct supervision and control of the Commissioner of Highways, while the proposed law places this work under the direction of the county superintendent subject to such rules and regulations as may be prescribed by the commission, except in cases of extraordinary damage necessitating reconstruction or resurfacing, when the work must be performed in accordance with plans and specifications prepared or approved by the commissioner. Under the present law most of the cost of maintenance is met by the state, each town, however, contributing $50 annually for each mile or major fraction of a mile of state or county highways within its limits, each incorporated village paying 1½ cts. for each square yard of such highway within its corporate limits and each city of the third class paying 3 cts. and each city of the second class paying 4 cts for each square yard of such highway within its limits. Under the proposed law the cost is borne by the state, the towns, the incorporated villages and the cities of the second and third classes and also by the county. The towns, as under the present law, would pay $50 per mile for state and county highways within their limits. The amounts paid by incorporated villages and cities would be considerably greater, however, the amount for incorporated villages being increased to 2½ cts. per sq. yd., the amount for cities of the third class to 5 cts. per sq. yd. and the amount for cities of the second class to 7 cts. per sq. yd. The portion to be borne by the county is fixed at 2 per cent. of the total cost for each $1,000 of assessed valuation of property in the county per mile of road—that is, if the assessed valuation of a county were such that it amounted to $1,000 for each mile of road within the county, that county would pay 2 per cent. of the cost of maintaining its roads. If, however, the assessed valuation were such that it amounted to $2,000 for each mile of highway in the county, the county would bear 4 per cent. of the cost. As an example of how this would affect the distribution of cost, the case of Albany County may be cited. The estimated amount which will be required for maintenance in that county this year is $149,751. On the basis proposed in the new law, the county would pay 50 per cent. of this amount, or $74,875.50. The amount to be raised by the towns in the county by the $50-tax is $7,300, making the total amount to be paid by the county and the towns $82,175.50. This would leave $67,575.50 to be paid by the state at large. It should be noted in this connection that the amounts contributed by towns, incorporated villages and cities of the second and third classes under the proposed law as well as under the present law must be expended upon state and county highways within the limits of such towns, villages or cities.

The provision in the present law that the state shall aid the counties in the maintenance of their roads to the extent of 50 per cent. of the amount appropriated by that county for the maintenance of its roads during the preceding year, is unchanged.

Investigators Report on Street Paving in Nashville, Tennessee

A report on street paving in Nashville, Tenn., has been rendered to the Board of Commissioners by James Cameron of New York, N. Y., auditor, and Walter Douglas, of Barclay Parsons & Klapp, consulting engineers, New York, N. Y. It covers investigations into paving contracts aggregating $1,100,000, made during 1914 and 1915, and in addition makes recommendations for future work.

Previous to 1914 the report states little street improvement had been contracted for, but in that year considerable paving was ordered, most of it apparently without system. At the present time, of 217 miles of paved roadway 83 per cent. is of water-bound macadam, of which, according to the report, a large area must be surfaced with bituminous wearing surface in order to withstand automobile traffic.

The city must spend large amounts for street construction during the next ten years, the report states. The city engineer, working under instructions of the commissioners, should prepare programs several years ahead, making them sufficiently elastic to meet special needs or desires of abutting property owners. The report recommends the Washington plan of having a director of public works, one with municipal experience, to take charge of all engineering work, elected for a term of five years. An engineer of the kind necessary should not be paid less than $4,500 a year.

The report criticises a feature of the contracts made during the past two years. In these, construction and maintenance figures were given separately. The contracts, however, were awarded with consideration only of the construction bids, so that in some cases the total paid to the successful contractor was higher than the combined figures of one of his competitors. The city paid the amount specified for maintenance immediately after the completion of construction. The report advises that in all work still to be done under contracts already made, the commission retain the maintenance funds until the end of the five-year period, to insure prompt and proper repairs whenever needed.

While, as has been noted, the contracts were criticised, the investigators state that the work itself was well done. Both field and laboratory tests showed that every requirement was fully complied with and in some cases the thickness was greater than necessary.

The report advises the employment of a chemical engineer for testing materials.

Minneapolis, Minnesota, Plans Extensive Paving Program

According to present plans, the 1916 paving program adopted by the City Council of Minneapolis, Minn., will involve the expenditure of $1,060,000 and will be the most ambitious ever undertaken by the city. The amount which it is proposed to expend is $650,000 more than has been used in any one previous year.

It is proposed to include $800,000 worth of the new paving under the Elwell law and the balance under the old five-year payment plan.

The work which is planned includes the paving of 51 miles of boulevards and parkways.

In addition to the proposed work in Minneapolis proper, extensive road work is planned for the coming season in Hennepin County, Minn., of which the city is the county seat. County Superintendent Haycock has reported that approximately 1,000 miles of town roads in the county need improvement.

Bureau County, Ill., Plans to Build a Number of Bridges

F. R. Bryant, County Superintendent of Highways of Bureau County, Ill., has prepared a list of the bridges which the county contemplates building during the coming season. The locations and sizes of the proposed bridges are shown in the accompanying table.

The Skunk Island Bridge in Fairfield Township will probably be of steel on creosoted piles, but plans for all of the other work provide for reinforced concrete structures.

Bridge No. 45 in Arispie Township was washed out recently and the exact size of the new bridge had not been determined, nor is it entirely certain that this particular bridge will be built this year.

No.	Bridge	Township	Span (ft.)	Roadway (ft.)
28	Hawk's	LaMoille	12	20
32	Skunk Island	Fairfield	50	18
33	Kaiser	Ohio	20	20
34	Becker	LaMoille	30	20
35	Guither	Walnut	28	20
36	Hammarla	Walnut	20	20
37	Smith No. 2	Gold	35	18
38	Abbott	Mineral	26	20
39	Limerick	Dover	30	20
40	Hayden	Dover	30	20
41	Naffziger	Bureau	30	20
42	Ross	Bureau	30	20
43	Heuers	Bureau	20	20
44	Balla	Bureau	16	20
45	McManis	Arispie	40-60	18

Mississippi to Protect Coast Roads

The Mississippi Legislature is considering a bill designed to protect roads and streets along the Gulf Coast by means of seawalls. The measure states that where public roads and streets extend along the shores of any body of water, the officials of the town or county shall build and maintain walls, breakwaters and bulkheads and for that purpose may issue bonds or levy special assessments. It is provided that half of the cost shall be assessed against abutting property.

St. Paul, Minnesota, Street Work

The City Council of St. Paul, Minn., has set dates for hearings on nine paving jobs which, according to the preliminary estimates, will involve the expenditure of $147,000. It is proposed to do all of the work during the coming season. The nine jobs have been divided into groups and the hearings will be held at various stated times from February 26 to 29.

Paving in Louisville, Kentucky

The spring and summer paving program of the Louisville, Ky., Board of Public Works involves the expenditure of about $110,000. The board will open bids for the work on February 23. The specifications call for asphalt, vitrified brick and granite block pavements. Some of the work will be paid for wholly by owners of the property benefited while the remainder will be a charge against the city.

The Association of Road Commissioners of Hamilton County has been organized by district road commissioners, county highway commissioners and other public officials in Hamilton County, Tenn.

The Board of Commerce of Detroit, Mich., in its work for good roads, has issued a small folder entitled "Build the Maintenance into the Road," which discusses the question in a clear and concise manner.

The Pittsburgh Convention of the American Road Builders' Association

NOTE.—As readers of "Good Roads" are aware, there has been in certain quarters adverse criticism of the action of the directors of the American Road Builders' Association in deciding to hold a convention at Pittsburgh this month. From time to time in the past, reference has been made to this matter in these columns and there have been printed various resolutions adopted by the A. R. B. A. The association has recently issued the statement printed below, in which the entire matter is thoroughly covered. Space is given to this because it is a thorough review of the matter which presents both sides fully and impartially.

At a meeting of the Board of Directors of the American Road Builders' Association, held in New York City on February 4, 1916, the Executive Committee was directed to issue a statement outlining the circumstances which have led up to the present controversy concerning the action of the said Association in determining to hold its convention for 1916, at Pittsburgh, beginning February 28. The statement which follows is not put forward as an argument, but is simply a recital of the facts.

At a meeting of the Board of Directors, held at the Hotel Astor in New York on October 22, 1915, a report of the representatives of the American Road Builders' Association on the Executive Committee of the Pan-American Road Congress was presented, from which it appeared that the attendance at the Pan-American Road Congress, held in Oakland beginning September 13, under the joint control of the American Road Builders' Association and the American Highway Association, was disappointingly small, although the Executive Committee had prepared and presented an admirable program of valuable papers. While the small attendance was believed to have been due in large measure to the remoteness of the place at which the congress was held from the parts of the country from which most of the membership of both associations is drawn, to the fact that a great exposition was in progress in San Francisco, and to the absence of the usual exhibition, it was generally believed that the difficulties inherent in any plan for a joint meeting of the two associations were such as to discourage further attempts at such meetings.

At this same meeting of the directors there was presented a letter from the Chamber of Commerce of Worcester, Mass., relative to a proposed international road congress to be held in that city beginning December 14, 1915, and stating that it was proposed that one of the days of this congress was to be designated as American Road Builders' Association Day and inviting the association to take an active part in the congress. After extended discussion the following resolutions were adopted:

WHEREAS the International Road Congress, proposed to be held at Worcester, Mass., December 14 to 17, 1915, has suggested that December 15 be designated as American Road Builders' Association Day, and

WHEREAS such action, if taken and concurred in by the American Road Builders' Association, would tend to give the impression that the said Association is cooperating in the promotion and management of the congress, and

WHEREAS the American Road Builders' Association entered into an agreement in connection with the recent joint convention held at Oakland, California, to the effect that it would not hold another convention during the year 1915, and

WHEREAS the Board of Directors of the American Road Builders' Association deeply appreciates the honor extended to it by the management of the proposed Worcester Congress in suggesting that one day be set apart as American Road Builders' Association Day, and, while wishing to express its appreciation of this courtesy, it believes that the announcement that the Association has joined in the arrangement of the details of the congress might be construed as a violation of the pledge it has given; therefore,

BE IT RESOLVED that, while the Board heartily sympathizes with the efforts of the Chamber of Commerce of Worcester to arouse and further public interest in improved road construction and maintenance and commends to the members of the American Road Builders' Association the proposed road congress, it feels that under the circumstances this Association should refrain from participating as an association in the management of program of the congress.

There followed a general discussion concerning the time and place for holding the 1916 convention of the American Road Builders' Association at the close of which the following minute and resolution were unanimously adopted:

The American Road Builders' Association is the oldest national organization in the United States having for its purpose the establishment of the best standards for, and the dissemination of accurate information concerning the technical side of highway construction and maintenance and has consistently adhered and confined itself to the above named purpose. Its annual conventions have been from year to year of constantly increasing importance and have attracted an increasingly large number of those who are making highway improvement their life work. The holding of joint conventions or congresses with other organizations, either national or local, whose interests are more or less closely allied with ours has been frequently discussed during the last few years, but it was not until the present year that such a plan has been carried out under the name of the Pan-American Road Congress which was held at Oakland, California, September 13 to 17. While the papers presented at this congress were of great interest and value, the attendance was disappointingly small, notwithstanding the effort and expense which were incurred in order to make it a success. It seems quite evident that the American Road Builders' Association has its own field of activity, by confining itself to which it can most effectually advance the cause of highway improvement. Every effort to this end on the part of individuals or other organizations has had and will continue to have the cordial sympathy and good will of this Association, but in the belief that the technical side of highway improvement can be best advanced by an adherence to its past policy of holding its annual meetings independently of other organizations. It is

RESOLVED that the American Road Builders' Association hold its annual convention for the year 1916 during the month of January or February and at either Pittsburgh, Pa., or Cleveland, O., as may be determined by the Executive Committee.

Following this there was presented a communication addressed to the Secretary of the Association by Mr. S. E. Bradt, transmitting a resolution adopted by the American Highway Association at a meeting held in Oakland on September 16, 1915, which read as follows:

WHEREAS, the American Highway Association earnestly favors harmony and correlation of the organized good roads movement throughout the United States, it is ordered that a special committee of seven members be appointed by the Chair and empowered to confer with similar committees from other organizations, and to consider and present to the Association at a subsequent meeting, or prior to such meeting at a meeting of the Board of Directors, suitable recommendations for such changes in the constitution and by-laws and the working plan of the Association as will best secure these desired results as well as to bring into closer relation the efforts for road improvement in the eastern and western portions of the United States, and that the chairman of the meeting be the chairman of the committee.

After considerable discussion a resolution was adopted directing the President of the Association to write to Mr. Bradt advising him that the American Road Builders' Association did not believe it to be expedient or practicable to take any action of the kind suggested in the resolution of the American Highway Association at the present time, but that this action should not be construed as in any way antagonistic to the purpose outlined in the resolutions. On the following day the President of the Association addressed the following letter to Mr. Bradt:

Brooklyn, N. Y., October 23.

S. E. Bradt,
Chicago, Ill.

Dear Sir:—

At a meeting of the Directors of the American Road Builders'

Association held in this city last night. Mr. Powers, Secretary, presented your letter to him of October 7, enclosing copy of resolution passed by the American Highway Association at its meeting held on September 16, 1915.

The Road Builders' Association decided at its meeting to hold its next convention some time in January or February of next year.

I was instructed, however, in communicating with you in reply to your letter to us to say that this action should not be construed by you or your association as being in any way antagonistic to the purpose desired by you as indicated in your resolution; but the Directors felt that the working out of any plan of amalgamation or merging would require so much time that such plan could not be consummated before the time when the Road Builders' Association should have its next convention.

The Directors also felt that your letter was not quite explicit enough as to just what you wished each association to do. They felt that the resolution was quite general and covered a great deal of ground and if you could advise us definitely as to what you thought would be the best means of procedure to attain the desired result, I should be greatly obliged.

Yours truly,

(Signed) GEORGE W. TILLSON,
President, A. R. B. A.

No reply has been received to this communication.

Under date of November 10, Mr. L. W. Page addressed the following letter to the Secretary of the Association, submitting his resignation as a director for the reasons stated in the letter:

Mr. E. L. Powers,
Secretary, American Road Builders' Association,
150 Nassau Street, New York City.

Dear Sir:—

My attention has just been called to a copy of the Good Roads Magazine in which a convention of the American Road Builders' Association is officially announced by the directors, for January or February, to be held at Pittsburgh, Pa., or Cleveland, Ohio.

It was my understanding as well as of those who contributed the money for the Pan-American Road Congress, and of the general public, when the agreement for the Pan-American Road Congress was entered into by the American Highway Association and the American Road Builders' Association, that no other convention or congress would be held by either Association this season. I quote from the first announcement in the official program of the Pan-American Road Congress, issued by the official joint committee:

> The Pan-American Road Congress will be held at Oakland, California, September 13, 14, 15, 16 and 17, 1915. It will be under the joint auspices of the two leading national good roads organizations—the American Road Builders' Association and the American Highway Association, acting through a joint committee. These two associations in the past have each held separate congresses annually. It was felt, however, in view of the Panama-Pacific International Exposition, that there should be but one meeting this year, and that this should be held at some date during the Exposition.

The whole point and effort in bringing about the Pan-American Road Congress was that neither association should hold an independent convention this season. This was the argument used by the officials of the congress in soliciting funds to finance the convention.

It seems to me that in view of the above facts, for the Road Builders to hold their annual meeting a month or two later than is the usual custom, so as to have the date fall just within another calendar year, constitutes a breach of faith.

The present plan for holding this convention will simply mean that the Road Builders will have given up no annual convention, but merely deferred the usual convention a month or two.

In view of these facts, I feel it necessary hereby to submit my resignation as a member of the Board of Directors of the American Road Builders' Association, as it would be inconsistent with my views longer to remain a member of this board.

Very respectfully,

(Signed) L. W. PAGE,
Director.

Copies of the above letter were sent to the technical press and were generally distributed among manufacturers of road machinery and materials.

Following the announcement that the American Road Builders' Association was to hold its 1916 convention in Pittsburgh, beginning at the end of February, 1916, several statements were made to the effect that this action was in conflict with the agreement between the American Road Builders' Association and the American Highway Association to the effect that the Pan-American Road Congress in Oakland should take the place of the meetings for that season of the two associations and that it was also in violation of representations made to those who were solicited to become donor or temporary members of the congress, without whose support it would have been impossible to finance the congress.

A meeting of the Executive Committee of the Pan-American Road Congress was held on November 27, 1915, at which there were present Governor Charles W. Gates of Vermont, Chairman of the Committee, Messrs. W. W. Crosby and E. L. Powers representing the American Road Builders' Association and Mr. J. H. MacDonald representing the American Highway Association, while Mr. MacDonald held the proxy of Mr. J. E. Pennybacker, the other representative of the latter association. The following resolution was adopted by this committee without dissent.

WHEREAS information and communications have reached the members of this Committee to the effect that this Committee, or its Treasurer and Chairman of its Sub-Committee on Finance, had solicited funds for the Pan-American Road Congress with the understanding that neither the American Road Builders' Association nor the American Highway Association would hold another convention within twelve months after the date of the Pan-American Road Congress (September 13-17, 1915) and

WHEREAS the members of this Committee do not know nor have they known of any agreement by the two associations or by their authorized representatives that neither association would, in view of the holding of the Pan-American Road Congress, September 13-17, 1915, hold a convention before September 13, 1916, but have recognized and do now recognize the existence of an agreement that neither association will hold a convention during this year, 1915,

THEREFORE BE IT RESOLVED that, after examination of the correspondence of the Treasurer of this Committee, we do not consider that in his solicitation of contributions toward the Pan-American Road Congress he has exceeded his instructions or in any way bound either the American Road Builders' Association or the American Highway Association not to hold a convention after January 1, 1916, and

BE IT FURTHER RESOLVED that we do not consider, in view of the facts mentioned, and others incidental thereto, that this Committee has in any way bound either the American Road Builders' Association or the American Highway Association not to hold one or more conventions after January 1, 1916, though we do consider each association bound in good faith not to hold or, as an association, to participate in any convention during the calendar year 1915.

On December 8 the Association of State Highway Officials, at a meeting held on that date in Chicago, adopted the following resolutions:

WHEREAS, the attending of the many road congresses has become a serious question with state highway officials not only in the time consumed and in the interference with official duty, but also in the matter of expense, and,

WHEREAS, the maintenance of two associations of national scope working independently and without harmony is a detriment to the good roads movement,

THEREFORE BE IT RESOLVED, that the members of this Association oppose the holding of any national road congress prior to December 1, 1916, and do hereby bind ourselves not to attend or participate in any manner in any national road congress held prior to that date.

BE IT FURTHER RESOLVED, that we urge the executives of our respective states not to appoint any delegates to represent the said several states in case any national road congress is held prior to said date.

BE IT FURTHER RESOLVED, that it is the sense of this Association that for the good of the road movement the American Road Builders' Association and the American Highway Association should amalgamate into one organization, or that they should at least arrange to hold jointly one annual road congress, and should they fail to arrange prior to August 1, 1916, for such a joint congress to be held in December, 1916, or early in 1917, then the Executive Committee of this Association is authorized to designate the date and place of our next meeting, and notify the above associations of the same, requesting them to hold a joint meeting at that time and place.

BE IT FURTHER RESOLVED, that if the said associations shall amalgamate or make a harmonious arrangement for an annual joint congress to be held as above suggested, we hereby pledge the hearty support and cooperation of this Association, and,

BE IT FURTHER RESOLVED, that the Secretary of this organization forward to each state highway department of the several states not represented at this meeting, also to the engineering department or board of public works in all cities of the United States having a population in excess of 100,000 and also to all manufacturers of road machinery, materials and supplies, a copy of these resolutions, asking for their approval and cooperation in carrying out the same.

BE IT FURTHER RESOLVED, that a copy of these resolutions be forwarded to the Secretary of the American Road Builders' Association and to the Secretary of the American Highway Association.

While the A. R. B. A. took no official part in the Worcester road congress, a large number of the members of the Association attended the congress individually and a number of them presented papers. On December 16, 1915, a meeting of the Board of Directors was held at Worcester at which, after full discussion, the following resolutions were adopted:

WHEREAS the American Road Builders' Association for several years has had under consideration the proposal to change the time of holding the annual convention, and being convinced that the best time for the holding of a highway convention or congress is immediately before rather than after the actual working season, has determined that its convention for 1916 shall be held in Pittsburgh, Pa., beginning February 28, 1916, and

WHEREAS this Association is desirous of avoiding the holding of a series of national conventions during any one year, thus imposing upon highway officials and those who may wish to exhibit at such conventions the materials, supplies and machinery produced by them, the burden and inconvenience of attending such different meetings, and

WHEREAS this Association, while convinced that an amalgamation of the different associations dealing with highway problems is inexpedient at the present time and that the holding of joint conventions under joint control is impracticable, believes that it would be entirely feasible for the two leading highway associations to hold their annual conventions at the same time and place, therefore be it

RESOLVED that the Board of Directors of the American Road Builders' Association, in behalf of the said Association, hereby extends to the American Highway Association an invitation to hold its annual convention for the year 1916 at Pittsburgh at the same time as that of the American Road Builders' Association, with the assurance that this Association will do everything in its power to contribute to the success of both meetings, and

BE IT FURTHER RESOLVED that, in case the American Highway Association favorably considers this invitation, the Executive Committee of the American Road Builders' Association, or such special committee as may be appointed by the President, be authorized to take up with the appropriate officers or committee of the American Highway Association the question of the preparation of a program for the two meetings, which shall avoid the duplication of subjects and will provide a program which will be of the greatest possible interest and profit to the members of both associations and all others interested in the question of highway improvement; and that said Committee be further authorized to make such provision as may be necessary for the meeting of the sessions under the control of the American Highway Association or the meetings of Committees of said association without expense to it, and also,

BE IT FURTHER RESOLVED, that it is the hope of the directors of the American Road Builders' Association that some plan such as has been outlined may be found satisfactory, not only for the meetings of 1916, but for subsequent meetings which may be held under alternate control.

Copies of these resolutions were at once mailed to the President and Secretary of the American Highway Association and the Executive Committee and, although a number of letters had been written inviting the presentation of papers at the Pittsburgh meeting, these letters were held back in order that, if the American Highway Association decided to give favorable consideration to the invitation extended to it by the resolutions adopted at Worcester, the programs of the meetings of the two associations might be arranged to avoid any duplication, the Executive Committee of this Association, believing that all the papers at our convention should be confined to the technical features of road improvement, and that such subjects as legislation, finance, administration and organization should be left to be covered by the papers presented at the meeting of the American Highway Association. On January 12, 1916, the American Highway Association, at a special meeting held in Washington, adopted the following resolutions, which were duly transmitted to the Secretary of this Association:

RESOLVED, that in view of the understanding very definitely reached prior to the Pan-American Road Congress at Oakland, California, in September, 1915, that there would be no other national road meeting during the succeeding twelve months, the American Highway Association feels that in good faith to all interested in the good roads movement it cannot accept the invitation of the American Road Builders' Association to participate in its proposed congress of February-March, 1916.

RESOLVED FURTHER, that this Association expresses its entire sympathy with the plans and purposes of the American Association of State Highway Officials as outlined in their resolution of December 8, 1915, and will lend all its efforts to the successful carrying out of that plan. With that end in view it is the purpose of the American Highway Association to cooperate with the American Association of State Highway Officials in its proposed joint congress to be held in December, 1916, or at a later date.

At the meeting of the Directors of the American Road Builders' Association held on February 4, the following resolution was adopted:

RESOLVED, that in view of the definite statement made in the resolution passed by the American Highway Association on January 12, 1916, as follows:

> In view of the understanding very definitely reached prior to the Pan-American Road Congress at Oakland, California, in September, 1915, that there should be no other national road meeting during the succeeding twelve months

the Secretary be directed to request the submission of evidence or references to establish facts upon which that statement was based, as regards time, place and by whom.

The above statement indicates the several steps taken by the American Road Builders' Association and sets forth the considerations which prompted them. It is put forward at this time in order that highway officials, contractors and manufacturers of material and machinery for road improvement may have a fair idea of just what has happened and may draw their own conclusions as to whether the American Road Builders' Association has been guilty of a violation of the letter or spirit of any obligations it may have assumed.

Respectfully submitted,

NELSON P. LEWIS,
A. W. DEAN,
E. L. POWERS,

Executive Committee of the American Road Builders' Association.

New York, N. Y., Feb. 7, 1916.

Road School at Purdue University

The road school at Purdue University, which has been announced in previous issues of "Good Roads," was held on January 24, 25 and 26. According to reports, the attendance was large and the three-day meeting entirely successful.

The meeting was held under the direction of the School of Civil Engineering of the university, the program consisting of lectures, discussions and demonstrations. Among the lecturers were Dr. L. I. Hewes, Chief of Economics and Maintenance, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; Charles Nelson, President, Indiana County Commissioners' Association; President C. C. Schofield of Purdue University; P. P. Sharples, Manager, General Tarvia Department, Barrett Co., and Prof. G. E. Martin of Purdue.

Experiments on the Distribution of Pressures Through Soils are to be conducted by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture at the government's Arlington farm near Washington. According to information received from the office, there will be installed an especially designed apparatus with which measurements will be taken of earth pressure in a large number of positions during a single application of the load. The apparatus, it is stated, can be used on earth fills up to 10 ft. in thickness.

COMING MEETINGS

February 21-22—National Paving Brick Manufacturers' Association—Meeting, Hotel Statler, Cleveland, Ohio. Secretary, Will P. Blair, Brotherhood of Locomotive Engineers Bldg., Cleveland, Ohio.

February 21-23—Idaho Society of Engineers—Annual meeting, Burley, Idaho. Secretary, Ira F. Shaffner, Boise, Idaho.

February 22-23—Arkansas Engineering Society—Annual meeting, Helena, Ark. Secretary, W. J. Parkes, Pine Bluff, Ark.

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 9—Vermont Society of Engineers—Annual meeting, Hotel Vermont, Burlington, Vt. Secretary, George A. Reed, Montpelier, Vt.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

The annual meeting of the Board of Supervisors' Association of Cambria County, Pa., will be held March 3 at Ebensburg, Pa. It is expected that members of the State Highway Department will be present and address the meeting. J. F. Boyer, Johnstown, Pa., is Secretary of the association.

A meeting of the Municipal Engineers of the City of New York will be held February 23. A paper entitled "The New Roads Around Ashokan Reservoir," will be presented by the following officials of the Board of Water Supply of New York City; Francis B. Marsh, Assistant Designing Engineer; J. D. Groves, Assistant Engineer, and Charles E. Price, Inspector.

MEETINGS

New York State Association of County Superintendents of Highway

At the recent annual meeting of the New York State Association of County Superintendents of Highways officers were elected as follows:

President, James F. Laughran, Ulster County; First Vice President, Richard T. Mace, Clinton County; Second Vice President, Charles Van Amburg, Broome County; Treasurer, Frank E. Bogardus, Onondaga County; Secretary, Dwight B. Coleman, Cortland County.

Virginia Road Builders' Association

At the annual meeting of the Virginia Road Builders' Association, held at Richmond, Va., January 18 to 20, the following officers were elected:

President, O. L. Evans, Amherst; First Vice-President, J. B. Wood, Richmond; Second Vice-President, G. Taylor Gwathmey, Norfolk; Secretary and Treasurer, C. B. Scott, Richmond.

The Executive Committee for 1916 is made up as follows: W. C. Saunders, Glen Allen, Chairman; J. F. Harper, Waynesboro; E. S. Finney, Lebanon; M. B. Rowe, Fredericksburg; Wade H. Massie, Washington; B. R. Cowherd, Columbia; S. L. von Gemmingen, Lynchburg; R. H. Wood, Charlottesville; G. P. Coleman, Richmond; Charles T. Lassiter, Petersburg; John E. Walker, Salem.

County Road Engineers of Kentucky

At the annual meeting of the County Road Engineers' Association of Kentucky, which closed at Lexington, Ky., February 5, the following officers were elected for the ensuing year.

President, W. H. Edwards, Woodford County; First Vice-President, William P. Caldwell, Boyle County; Second Vice-President, Clinton Woodward, Jessamine County; Third Vice-President, R. W. Davis, Fayette County.

PERSONAL NOTES

Joseph M. Tracey has been appointed City Engineer of Ogden, Utah.

James H. Farrar, Jackson, Tenn., has been elected County Engineer of Lauderdale County, Tenn.

R. D. Goodrich, City Engineer of Cheyenne, Wyo., has resigned to become Manager of the municipal public utilities of Ypsilanti, Mich.

William B. Bennett, a consulting engineer of Niagara Falls, N. Y., has been appointed City Engineer of that city. He will continue his private practice.

George Hogarth, Assoc. M. Can. Soc. C. E., formerly Assistant Engineer of the Department of Public Works of the Province of Ontario, Canada, has been appointed Chief Engineer of the Department.

Gordon I. Lindsay, for several years New York State agent for the Robeson Process Co., New York, N. Y., has resigned to accept the position of Secretary and General Manager of the American Gum Products Co., 200 Fifth avenue, New York, N. Y., manufacturers of sulphite pitch.

John H. Lewis, Assoc. M. Am. Soc. C. E., Oregon State Engineer, has been given supervision of all state road and bridge work and has placed E. I. Cantine, M. Am. Soc. C. E., in charge of road work. The office of State Bridge Engineer has been abolished by Mr. Lewis on the resignation of H. W. Holmes, Assoc. M. Am. Soc. C. E., who is going into private practice.

NEWS OF THE TRADE

The Good Roads Machinery Co., Inc., Fort Wayne, Ind., has issued a 32-page booklet entitled "Everything for the Road Maker." It contains descriptions of the company's complete line of road making machinery and is profusely illustrated.

The Autocar Co., Ardmore, Pa., has let contracts for an additional factory building which will add 85,000 sq. ft. of floor space to the company's plant. The building will be two stories high, with a main building, two L extensions, a boiler house and a blacksmith shop. The main building will be used for the manufacture and painting of Autocar bodies and the final assembly of bodies and chasses. The new building, together with the five-story addition now under construction, will more than double the capacity of the Autocar plant.

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Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

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Operations of the New Jersey Department of Public Roads During 1915

There was available for expenditure by the Department of Public Roads of New Jersey during the fiscal year from November 1, 1914, to October 31, 1915, a total of $2,409,319.67. Of this amount $890,419.56 was from the public road funds, $145,300 from general appropriations and $1,373,600.11 from the motor vehicle account. From the public road funds there was expended $301,891.51 and $492,729.96 was carried forward on contracts. Of the balance, $9,840.50 was outstanding on requisitions at the end of the fiscal year and $85,957.59 lapsed to the state treasury. Of the $301,891.51 expended from the public road funds, $228,267.65 was paid on contracts. The balance of the expenditure was paid for extras, engineering, inspection, etc. There was expended from the general appropriations $110,139.39, the largest single expenditure being $82,053.83 on the convict labor. The balance of the expenditure from these appropriations was made for salaries of the state highway officials and the staff of the Department of Public Roads. There was expended a total of $851,214.89 from the motor vehicle account. Of this, $751,277.39 was expended in allotments for the repair of various roads throughout the state.

The foregoing figures are taken from an advance copy of the twenty-second annual report of the State Commissioner of Public Roads, submitted by Commissioner E. A. Stevens. Besides the financial data already reviewed, the report contains detailed information on the work in each county and a number of tables containing interesting data on the state's road work during 1915 and preceding years. One of these tables shows the total number of miles of road built by state aid in each county since the passage of the state aid law. The first of the accompanying tables, made up from the one in the report, shows the totals for all counties for each year.

According to another table in the report, the estimated road mileage of the state is 20,445.44, which is classified as shown in Table II.

Another table shows the character of the roads making up the total mileage of 20,445.44. These data are shown in Table III.

TABLE I—NUMBER OF MILES OF ROAD BUILT WITH STATE AID IN NEW JERSEY DURING EACH YEAR SINCE THE PASSAGE OF THE STATE AID LAW.

Year.	Miles
1893	27.340
1894	32.280
1895	46.330
1896	60.820
1897	66.655
1898	81.938
1899	114.460
1900	77.212
1901	109.376
1902	154.005
1903	152.920
1904	105.637
1905	67.780
1906	88.571
1907	82.165
1908	134.173
1909	86.709
1910	42.550
1911	86.925
1912	105.678
1913	148.967
1914	102.046
1915	52.929
Total	1,977.466
Built in 1892 in Middlesex County	10.550
Grand total	1,988.016

TABLE II—CLASSIFICATION OF NEW JERSEY HIGHWAYS.

Kind of Road	Estimated Mileage
County Roads	2,431.95
Township Roads	12,385.25
Borough Roads	2,138.86
Town Roads	852.77
Village Streets	89.40
City Streets	2,508.81
Toll Roads	38.40
Total	20,445.44

TABLE III—KINDS OF ROADWAYS IN THE NEW JERSEY HIGHWAY SYSTEM

Kind of Road	Estimated Mileage
Brick	143.05
Concrete	15.40
Bituminous Macadam	472.77
Plain Macadam	3,171.68
Gravel	3,598.44
Shell	88.71
Bituminous Concrete	544.25
Sand and Clay, Cinders	704.87
Graded Roads	6,123.24
Unimproved	5,174.64
Wood Block	15.61
Stone Block	310.76
Cobble	22.69
Asphalt Block	20.93
Toll Roads	38.40
Total	20,445.44

Under the state aid act there have been constructed in the different counties of the state the following areas of various kinds of pavement, the amount in each case being in square yards: Water bound macadam, 9,229,186; macadam with bituminous dressing, 869,874; bituminous macadam, 338,386; concrete, 5,998; bituminous mortar macadam, 19,293; bituminous concrete, mixed hot, 242,791; bituminous concrete, mixed cold, 856,391; concrete base bituminous dressing, 10,513; gravel, 6,212,955; oyster shells, 195,510.

In Commissioner Stevens' report, especial attention is called to the increasing burden of maintenance work. He states that the increase in the receipts from motor vehicles has not been in proportion to the increase in the demand for assistance from the various counties, and that while five years ago from one-third to one-half of the amount needed to keep the main arteries of traffic in repair could be met out of the motor vehicle fund, it had been impossible, during 1915, to provide more than about 20 per cent. of the money which should have been spent for this purpose. He states that the reason for this is very apparent upon analysis of the conditions, since it can be proved that, on the average, an automobile traveling 6,000 miles in a year inflicts damage to the amount of from $30 to $35 on the roads, while it pays a license fee of only $7.50. He also estimates that the damage done by the ordinary two-horse team can be repaired at a cost of not over $8.

In discussing the inadequacy of the present law, he points out that only a very small portion of it refers to repair work, but that at present such work consumes twice as much of the state funds as does construction and that the proportion of county funds expended for repair work is probably even greater. He points out that as both mileage and traffic show further increases, the cost of repairs and the ratio of this cost to the total road expense must continue to increase.

Another disadvantage of the present law which Commissioner Stevens points out is that the state aid act, as interpreted to make it consistent with the requisition act, provides that no allotment from the motor vehicle fund can be made to a county until the money has been actually collected. The law also directs that the motor vehicle money be spent for the most important improved roads and that aid can be given for resurfacing and extraordinary repair, which at present is the department's most important work, only by setting aside by allotment the state's share of the cost at the time the plans and specifications are approved. He points out that this work should be arranged for early in the year so that it can be begun toward the end of March or the beginning of April. At that time, however, there is little money available and allotments can not be made in sufficient amounts to provide for more than a small amount of the work until toward the end of spring. Moreover, after the approval of specifications, it is necessary to advertise for three weeks. The result is that this most important work can not be begun until the season of the heaviest traffic, to the great inconvenience of the public and at a considerable increased expense. Because of these conditions the work is largely done without state aid.

Among other objections to the law cited by Commissioner Stevens are the division of the road money into various funds and the placing with local governing bodies much of the control over engineering details which are largely of a technical character and require fixity of administrative policy.

In recommending remedial legislation Commissioner Stevens points out the need for businesslike conduct of the work by experts who can work without political interference. He also states that there are two matters of detail which he believes must be provided for. The first is to definitely state the problem in figures and the second is the creation of a proper road force. He points out that the first will require a survey of the roads of the state and a thorough and uniform accounting system to show not only the money expended but also the service rendered therefor. In regard to the second, he points out that the present system of choosing county engineers and supervisors of roads for a limited term and the failure to provide co-operation are inconsistent with efficiency. He states that there must be a force that, by its trained ability and thorough teamwork, will command the confidence of the public and that such a force can not exist without permanent tenure of office.

Work of the Oklahoma Department of Highways During 1915

The State Department of Highways of Oklahoma, which was created by act of the last Legislature and which was organized June 22, 1915, has recently issued a report of the work accomplished between the date of organization and December 31, 1915.

Among other duties provided by the new highway law, a brief digest of which was published in "Good Roads" for August 7, 1915, the department is charged with the registration of motor vehicles. During 1915 these registrations included 25,019 automobiles and motor trucks, 1,775 motorcycles, 592 tractors and 668 dealers in motor vehicles. The taxes collected amounted to $154,198.58.

Eighty-eight applicants were examined for the position of county engineer and of these 36 were given permanent certificates of competency and 23 were given temporary certificates, so that 59 engineers were available for service in the 77 counties of the state, the law providing that one engineer may serve for more than one county.

More than 250 plans for bridges to be erected at an approximate cost of $425,000, and 50 plans for culverts to cost about $20,000, have been examined and approved and plans and profiles for more than 200 miles of state roads have been presented and approved.

State road systems have been designated by 71 counties, the total mileage so designated being 12,604. Reports from 46 counties indicate that 1,370 miles of state roads have been surveyed and plans and profiles made and approximately 2,000 miles of the 12,604 miles noted above have been constructed. This mileage does not include township roads that are being constructed under township bond issues.

Of the state roads built, all but about 21 miles are earth roads, the remainder being of concrete, macadam or gravel.

A large amount of money has been expended for road building equipment and for the preparation of plans, etc., and this expenditure has naturally cut down the amount available for construction work, although, as the report points out, the expenditures are really in the nature of an asset.

It is expected that during the current year between 3,000 and 5,000 miles of state roads will be built. It is expected also that this estimate will be greatly exceeded if arrangements can be made to use state convicts on road work.

The report calls attention to the fact that considerable interest is manifested in the construction of brick, macadam and concrete roads and states that many counties will vote bond issues of from $50,000 to $500,000 for such construction provided the 1916 Legislature encourages by law the means of obtaining these funds. The report concludes with the statement that 1916 promises to be extremely active in road and bridge construction throughout the state.

Harris County, Texas, Road Work

In a report to the County Judge, W. V. Burnell, County Engineer of Harris County, Tex., gives the results of the expenditure of the proceeds of the county's bond issue of $1,000,000 for good roads.

The work included the construction or repair of 200.6 miles of roads, the construction of two bridges, 23 concrete culverts, 80 standard wooden culverts and 10 creosoted pine trestles.

The American Road Builders' Association and the Pittsburgh Convention

The American Road Builders' Association, which holds its thirteenth annual convention in Pittsburgh on Monday, Tuesday, Wednesday, Thursday and Friday of next week, is the oldest organization of its kind in this country and the only one which devotes its attention exclusively to the every-day problems of the road builder. It has held a series of most successful conventions beginning with the meeting at Detroit, Mich., in February, 1903, and since 1909, except in 1915, has held a good roads show in connection with its convention.

MECHANICAL HALL, PITTSBURGH, PA., WHERE THE THIRTEENTH ANNUAL CONVENTION OF THE AMERICAN ROAD BUILDERS' ASSOCIATION AND THE SEVENTH NATIONAL GOOD ROADS SHOW WILL BE HELD, FEBRUARY 28 TO MARCH 3.

The objects of the Association are "to acquire and disseminate information concerning highway construction and maintenance in the states and cities of the Union and in the provinces and cities of Canada; to stimulate interest in the subject, and to promote educational, legislative and other measures tending to their accomplishment." The membership is divided into five classes—active, associate, honorary, contributing and life. The majority of the members are, of course, of the first class and, according to the constitution, are those "actively engaged in laying out or supervising work of construction and maintenance of highways and streets and those interested in highway development." Members of the remaining classes are as follows: Associate members are societies or other organizations interested in the objects of the Association; honorary members are those who have performed distinguished service in the cause of highway improvement, and who are nominated by the Board of Directors and elected by the Association; contributing members are commercial bodies contributing $100 per year, and life members are active or associate members making payments of $500 upon election to membership. Only active members may vote or hold office. The dues for active members are $3.00 per year; for associate members, $10, and contributing, $100.

The officers of the Association consist of a president, three vice presidents, a secretary, a treasurer and eighteen directors. These, together with the last five living past presidents, constitute the Board of Directors, from which there is elected an executive committee of three, one of which is the secretary of the association, to have direct charge of the work of the organization. The executive officers are elected for terms of one year each, while directors are elected to serve for three years, six being elected each year.

The present officers of the Association are as follows: President, Col. E. A. Stevens, Commissioner of Public Roads of New Jersey; First Vice President, Arthur W. Dean, Chief Engineer, Massachusetts Highway Commission; Second Vice President, Austin B. Fletcher, State Highway Engineer of California; Third Vice President, Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Secretary, E. L. Powers, Editor, "Good Roads"; Treasurer, Major W. W. Crosby, Consulting Engineer, Baltimore, Md.

Past Presidents (ex-officio members of the Board of Directors): Harold Parker, Ex-Chairman, Massachusetts Highway Commission; Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment of New York City; Samuel Hill, President, Washington State Good Roads Association; W. A. McLean, Deputy Minister of Highways, Province of Ontario, Canada; George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.

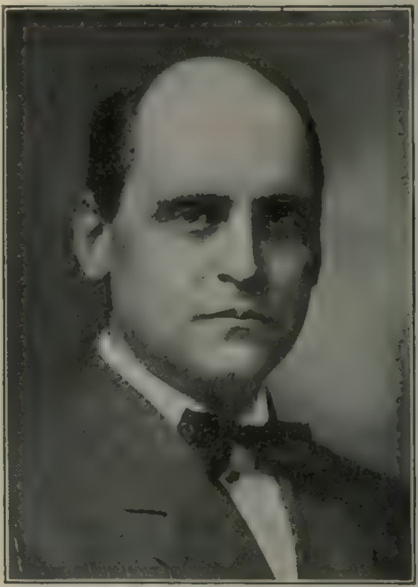
Directors (terms expire 1919): R. Keith Compton, Chairman and Consulting Engineer, Paving Commission, Baltimore

Md.; Charles W. Gates, Governor of Vermont; James H. MacDonald, Ex-State Highway Commissioner of Connecticut; R. A. Meeker, State Highway Engineer of New Jersey; Wm. D. Uhler, Chief Engineer, Pennsylvania State Highway Department; Frank M. Williams, State Engineer and Surveyor of New York.

Directors (terms expire 1918): E. A. Fisher, Rochester, N. Y.; A. R. Hirst, State Highway Engineer of Wisconsin; Joseph W. Hunter, First Deputy Commissioner, Pennsylvania State Highway Department; Frank F. Rogers, State Highway Commissioner of Michigan; William R. Smith, General Manager, Lane Construction Corporation; H. M. Waite, City Manager of Dayton, Ohio.

A. W. DEAN,
First Vice President.

COL. E. A. STEVENS,
President.


A. B. FLETCHER,
Second Vice President.

MAJ. W. W. CROSBY,
Treasurer.

WM. H. CONNELL,
Third Vice President.

E. L. POWERS,
Secretary.

EXECUTIVE OFFICERS OF THE AMERICAN ROAD BUILDERS' ASSOCIATION

Directors (terms expire 1917): T. R. Agg, Professor of Highway Engineering, Iowa State College; W. E. Atkinson, State Highway Engineer of Louisiana; Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; Fred E. Ellis, Manager, Essex Trap Rock & Construction Co.; R. H. Gillespie, Chief Engineer of Sewers and Highways, Borough of the Bronx, New York, N. Y.; Paul D. Sargent, Chief Engineer, Maine State Highway Commission.

Thirteenth Annual Convention

The Thirteenth Annual Convention of the Association will be held, as has been noted in previous issues, at Pittsburgh, Pa., on February 28 and 29 and March 1, 2 and 3. The sessions of the convention will be held at Mechanical Hall, in which the exhibits of machinery and materials, comprising the Seventh National Good Roads Show held under the association's auspices, will also be housed. Mechanical Hall is a large building which is well adapted to the needs of the meeting and is conveniently situated on Duquesne Way, near the junction of the Monongahela and Allegheny Rivers. It is very nearly at the extreme westerly end of the "Point" and, therefore, in the heart of the downtown business section. It is within a short distance of the principal hotels and railroad stations and may be conveniently reached by street cars or by a short walk. The headquarters of the Association for the registration of delegates and the distribution of badges and programs will be at Mechanical Hall, while the hotel headquarters will be at the Hotel William Penn.

The entertainment features of the convention will include a theater party and smoker on Tuesday evening, the annual A. R. B. A. dinner and entertainment on Wednesday evening, and an automobile trip on Thursday afternoon if the weather is suitable. The theater party and smoker and the automobile trip are being arranged by citizens of Pittsburgh. The personnel of the Pittsburgh committees is as follows:

General Chairman, E. M. Bigelow.

Executive Committee: S. L. Tone, Chairman; W. A. Donkin, Secretary; W. S. Brown; W. H. Davis; Wm. Flinn; Chas. J. Graham; H. Lee Mason, Jr.; Samuel Moody; Robert McAfee; Geo. S. Oliver; H. P. Pears.

Finance Committee: R. H. Boggs, Chairman; S. L. Tone, Treasurer; Geo. S. Oliver; John F. Casey; Donald McNeil.

Transportation Committee: Samuel Moody, Chairman; F. W. Conner; Wyn B. Morris; C. O. D. Pascault; Joseph Taggart.

Press Committee: W. H. Davis, Chairman; Austin Beech; H. W. Bittner; W. N. Christman; J. K. Emge; T. D. Harman; I. E. Hirsch; F. W. Merchant; A. K. Oliver.

Hotel Committee: Chas. J. Graham, Chairman; J. Toner Barr; A. C. Gumbert; Chas. N. Hanna; Jas. E. Porter.

Entertainment Committee: W. S. Brown, Chairman; Louis Bihler; Jas. F. Burke; Wm. H. Davis; Col. Samuel D. Foster; Chas. J. Graham; Royal S. Goldsbury; E. J. Kent; Geo. W. McCandless; H. E. McLain; John McLeod; George S. Oliver.

Printing and Program Committee: H. P. Pears, Chairman; J. S. Gillespie.

Automobile Committee: H. Lee Mason, Jr.; Chairman; Dr. Jno. A. Hawkins; Wm. A. Heyl; E. J. Kent; Edw. Kneeland; Wm. N. Murray; Robt. P. McCurdy; Frank D. Saupp; Wm. Seif; Paul C. Wolff.

The program corrected to date is printed below. While there may be some slight changes, the program as a whole is final. It should be noted in connection with the program that, as at the Chicago convention in 1914, the number of papers scheduled for each session has been made small enough so as to leave plenty of time for general discussion. It may also be noted here that many of the papers are by men who have not before taken prominent parts in A. R. B. A. conventions. These men were assigned topics partly because it was believed that they would bring new ideas to bear in the treatment of their respective subjects. An innovation in this year's program is the inclusion of papers descriptive of special work. At the sixth session papers on the Columbia Highway and the du Pont Road will be presented by Henry L. Bowlby, former State Highway Engineer of Oregon, and Chas. M. Upham, Chief Engineer of the Coleman du Pont Road. The program follows:

MONDAY, FEBRUARY 28

Registration of delegates and visitors during afternoon and evening at headquarters, Mechanical Hall.

Opening of Seventh National Good Roads Show, 3 p. m.

Public Meeting, Memorial Hall, 8 P. M.

Address by Martin B. Madden, M. C., of Chicago, Ill.

Address by Wm. C. Bennett, M. C., of New York N. Y.

Address by Dorsey W. Shackleford, M. C., of Jefferson City, Mo.

TUESDAY, FEBRUARY 29

9 a. m., and during day. Registration of delegates and visitors.

10 a. m. Appointment of committees. Meetings of committees.

First Session, 11:00 A. M.

Congress called to order in Convention Hall by the President of the A. R. B. A.

Address of Welcome on behalf of the City of Pittsburgh.

Address of Welcome on behalf of the State of Pennsylvania.

Address of Welcome on behalf of the Department of Highways of the State of Pennsylvania.

Address of Welcome on behalf of the County Commissioners of Allegheny County.

Address of Welcome on behalf of the Pittsburgh Chamber of Commerce.

Response on behalf of the American Road Builders' Association by the President.

Addresses by Representatives of the State Highway Departments.

Second Session, 2:30 P. M.

"Railway Track Construction in Paved Streets,"
R. Keith Compton, Chairman, Paving Commission, Baltimore, Md.

Discussion opened by W. H. Taylor, Jr., City Engineer, Norfolk, Va.

General Discussion.

"The Control of Openings in Pavements,"
N. S. Sprague, Chief Engineer, Bureau of Engineering, Pittsburgh, Pa.

Discussion opened by George E. Datesman, Director of Public Works, Philadelphia, Pa.

General Discussion.

WEDNESDAY, MARCH 1

Third Session, 10:00 A. M.

"Recent Developments in the Building of Concrete Roads,"
W. D. Uhler, Chief Engineer, Pennsylvania State Highway Department.

General Discussion.

"A Contractor's Suggestions to Engineers and Inspectors,"
John H. Gordon, Contractor for Road Improvements, Albany, N. Y.

Discussion opened by F. E. Ellis, Melrose, Mass.

General Discussion.

Fourth Session, 2:30 P. M.

"Adaptability of Paving Materials to Different Conditions and Localities,"
F. C. Pillsbury, Division Engineer, Massachusetts Highway Commission.

General Discussion.

"Roads at Low Cost for Moderate Traffic,"
F. E. Everett, State Highway Commissioner of New Hampshire.

Discussion opened by C. R. Wheelock, Orangeville, Ont.

General Discussion.

THURSDAY, MARCH 2

Fifth Session, 10:00 A. M.

"Brick Streets and Roads,"
H. E. Breed, First Deputy Commissioner, New York State Commission of Highways.

General Discussion.

"Recent Tendencies in Stone Block Pavements,"
Chas. F. Knowlton, Manager, Paving Department, Simpson Bros. Corp., Boston, Mass.

Discussion opened by H. W. Durham, County Engineer, Bergen County, New Jersey.

General Discussion.

"The Function of the Stone in Bituminous Concrete Pavement,"
R. B. Gage, Chemist, Department of Public Roads of New Jersey.

General Discussion.

2:00 P. M.

Automobile Trip as Guests of the Pittsburgh Chamber of Commerce (weather permitting).

Business Meeting.

Reports of Committees.

FRIDAY, MARCH 3

Sixth Session, 10:00 A. M.

"Foundations for Roads and Streets,"

Joseph W. Hunter, First Deputy Commissioner, Pennsylvania State Highway Department.

General Discussion.

"Columbia Highway,"

Henry L. Bowlby, former State Highway Engineer of Oregon.

"The du Pont Road,"

Chas. M. Upham, Chief Engineer, Coleman du Pont Road.

General Discussion.

Conference on Highway Engineering at Kansas Agricultural College

The Civil and Highway Engineering Department and the College Extension Division of the Kansas State Agricultural College will direct a conference on highway engineering which will be held at the college, February 28 to March 4.

The program has been prepared with particular regard to men whose experience in road building is limited and many of the lectures will be illustrated. The subjects to be discussed and the speakers are as follows:

February 28—Address of welcome, Dr. H. J. Waters, President Kansas State Agricultural College; Addresses by E. C. Johnson, Dean of College Extension, and A. A. Potter, Dean of Engineering; illustrated lecture and smoker at Commercial Club rooms.

February 29—"Construction of Earth Roads," A. R. Losh, Assistant State Engineer; "The Relation of Drainage to Road Building," H. B. Walker, Drainage and Irrigation Engineer, Kansas State Agricultural College; "Road Maintenance," W. S. Gearhart, State Engineer; "Dragging," C. F. Osborne, Howard County Engineer; "Sand-Clay, Oiled Sand, and Oiled Earth Roads," W. S. Gearhart; "Testing of Road Materials," P. J. Freeman, Assistant Professor of Applied Mechanics; "Patents Affecting Concrete Bridge Design and Construction," S. N. Hawkes, Assistant Attorney General; "Road and Bridge Construction in Iowa," Thomas J. McDonald, Chief Engineer, Iowa Highway Commission.

March 1—"Kansas Highway Laws," by S. N. Hawkes; "Highway Organization," T. H. McDonald; "Competent Engineering in Highway Construction," L. E. Conrad; "How Elk County Handles Its Highways," C. F. Osborne; "Developing a System of Highways," by L. E. Conrad, Professor of Civil Engineering; "Needed Changes in Our Highway Laws," J. T. Kincaid, President, Kansas Good Roads Association; "The Use of City, County, and State Prisoners in Road Construction," J. K. Codding, Warden, Kansas Penitentiary.

March 2—"Bridge Inspections and Required Waterways," C. I. Felps, Assistant Bridge Engineer; "Bridge and Culvert Design," C. B. McCullough, Bridge Engineer, Iowa State Highway Commission; laboratory inspection and demonstrations; "Bridge Letting, Construction and Inspection," W. S. Gearhart; "Bridge Costs," A. R. Losh; address, Dr. F. H. Newell, Professor of Civil Engineering, University of Illinois; "Origin of the Sands, Rocks and Gravels Used in Road Building," Dr. R. K. Nabours; "Road Building by the Reclamation Service in the Arid Region," Dr. F. H. Newell.

March 3—"Road Machinery and Equipment, Its Use, Cost and Care," A. R. Losh; "Engines Best Adapted to Road Work," W. H. Sanders, Instructor in Steam and Gas Engineering; road machinery demonstration; "Financing the Construction of Surfaced Roads," W. S. Gearhart; "Concrete Road Construction, Maintenance and Costs," L. E. Conrad; "Highway Bonds," Dr. L. I. Hewes, Chief of Economics and Maintenance, United States Office of Public Roads and Rural Engineering; "Concrete Road Construction and Maintenance," J. B. Marcellus, Portland Cement Association; "Construction of Macadam Roads," Dr. L. I. Hewes.

March 4—"Gravel Road Construction and Maintenance," H. E. Bilger, Road Engineer, Illinois State Highway Department; "Macadam Road Construction and Maintenance," Curtis Hill, City Engineer, Kansas City, Mo.; "Brick Roa Construction, Maintenance and Costs," H. E. Bilger.

State Aid Roads Accepted in 1915 by the Illinois Highway Commission

According to a recently issued report, the Illinois State Highway Commission accepted 31.51 miles of roads constructed at the joint expense of the state and counties, during the period between February 1 and September 1, 1915. This mileage represents an expenditure of $392,874.52.

Prior to February 1, 1915, the State Highway Commission had accepted 24.10 miles, costing $311,290, so that the total mileage of state aid road, for the perpetual maintenance of which the state is responsible, was 55.61 up to September 1 last.

The following table shows the location, mileage and cost of the various sections accepted by the state between February 1 and September 1:

County	Section	Type		Mileage	Total cost	Unit cost per mile
Boone	B	Concrete	10′	0.81	$9,107.86	$11,240
Dekalb	A	Concrete	10′	1.14	11,155.12	9,790
Dekalb	C	Concrete	10′	2.98	26,887.01	9,020
Stephenson..	A	Brick	18′	0.62	15,452.74	24,920
Logan	A	Concrete	10′	0.70	6,117.31	8,740
Logan	D	Concrete	10′	0.70	7,233.36	10,330
Whiteside ...	A	Concrete	10′	0.59	9,464.08	16,040
Cook	C	Concrete	18′	4.55	63,315.26	13,695
Warren	A	Brick	10′	1.04	14,734.74	14,170
Rock Island..	A	Concrete	10′	0.94	9,301.08	9,894
Jackson	A	Brick	10′	0.69	11,819.85	17,140
Williamson...	A	Concrete	10′	1.26	13,029.29	10,340
Champaign...	A	Brick	10′	1.46	19,691.21	13,490
Champaign...	B	Brick	10′	1.48	19,180.71	12,700
Jersey	A	Concrete	10′	0.59	5,861.44	9,930
Franklin	A	Concrete	10′	0.92	9,992.35	10,860
Douglas	A	Brick	10′	1.19	15,015.96	12,620
Lawrence ...	A	Concrete	10′	1.08	14,473.04	13,400
Coles	A	Brick	10′	1.31	18,302.82	13,970
Moultrie	A	Concrete	10′	1.34	12,607.78	9,408
Woodford.....	A	Concrete	10′	1.38	16,955.77	12,290
Grundy	A	Concrete	10′	1.80	20,314.51	11,290
Peoria	A	Concrete	10′	1.17	19,932.89	17,040
Rock Island..	B	Concrete	10′	0.57	6,059.64	10,630
Warren	B	Brick	10′	0.95	13,714.30	14,436
Edgar	C	Brick	10′	0.25	3,154.40	12,620
Total to Sept. 1, 1915.....	..	....		31.51	$392,874.52	....

Extensive Road Work Planned for 1916 in West Virginia

According to a statement by A. D. Williams, State Engineer of West Virginia, approximately $4,000,000 will be spent on highways in that state during the current year.

The total amount provided by county and district bond issues to date is $5,143,000, of which about $3,000,000 is as yet unexpended.

The following counties have spent or are to spend the amount noted: Hancock, three districts, $290,000; Marshall, one district, $150,000; Monongalia, one district, $300,000; Marion, two districts, $800,000; Wetzel, one district, $150,000; Preston, one district, $60,000; Wood, three districts, $300,000; Kanawha, six districts, $375,000; Summers, two districts, $230,000; McDowell, two districts, $458,000; Cabell, $900,000; Mercer, $850,000; Wyoming, $550,000; Total, $5,413,000.

Bond elections are pending involving $1,477,000 and bonds voted, but not yet sold amount to $350,000.

Causes of Defects in Some Grouted Granite Block Pavements*

By **CLARENCE D. POLLOCK**†

Since the advent of improved granite block pavements there have developed certain defects which were not noticed or did not occur with the old style, wide jointed granite block pavements.

Within the past few months the writer has had occasion to make a study of these defects—to determine, if possible, the cause and then the remedy for these flaws. First, an examination was made of granite block pavements in general. It was found that defects consisting of broken and loose blocks, often only a single block, and then again two or more adjacent ones, did not occur where some form of bituminous filler had been used, nor did it occur where the joint filler was simply sand, but the defects were found in some of the pavements where cement grout had been used as the joint filler. Next it was observed that the defects did not always develop when the joints consisted of cement grout.

A good many paving engineers believed that the trouble was due to a few soft or outcrop blocks getting mixed in with the good blocks. A careful examination was next made of numerous places in pavements in several cities. The examination showed that where the pavement was generally first class there was occasionally a small spot where one or two blocks would be broken or cracked. Often the cracks had the appearance of laminations. Sometimes it would be found that more blocks were broken, but usually there was only a small place like a pothole, as it might be termed. This was found to be the case with every kind of granite which had been used around New York City and vicinity, whether it was what is known as comparatively soft, medium or hard granite. These spots occurred at points where the grouting appeared to be in perfect condition for a considerable distance in all directions.

The fracture of the blocks was similar to that obtained in testing cubes for compression, and seemed to indicate that the trouble was due to pressure from expansion. Where the grout was poor and broken out there were no broken blocks. Upon removing blocks from the pavements at these potholes by beginning several blocks away from the broken ones the grout was found to be good, and it had penetrated well down into the joints, but when the joint immediately adjacent to the broken block was reached the grout proved to be good only for about 1 in. to 1¼ ins. down from the top of the block, and was either very poor or else simply pea stone or gravel below this. In every case the break in the block followed very closely the bottom line of the good portion of the grout. In other words, the top of the block had crushed and the bottom portion, where the grout was poor or missing entirely, remained intact. The blocks which were cracked and appeared laminated proved to be whole and sound except for the top portion above the bottom line of the good grout. All this thoroughly backed up the theory that the cause of the fracture was the pressure being concentrated upon the small area of the good grout and was not due to defective material in the blocks. Test cubes were made from the bottom portions of blocks which had crushed on top, selecting granites from various quarries in order that we might have all degrees of hardness, or rather crushing strength. Upon crushing the cubes it was found that each was normal for the quarry from which it came. The range was from granites having a crushing strength of about 15,000 lbs. per sq. in. to those having a crushing strength of over 30,000, and even 40,000 lbs. As further evidence that the crushing is due to expansion, one crushed block was removed from about the center of an actual bulge in the pavement, which had lifted from the sand cushion to a noticeable amount and gave forth a hollow sound when struck with a sledge. This was toward the close of a very hot spell which succeeded heavy rains.

As already stated, where all the grout was poor no broken blocks were found. But on the other hand where all of the grout was good, and filled the joints from the top to substantially the bottom of the blocks, such as in Worcester, Mass., upon Main St. and upon Front St., where a comparatively soft granite was used, not a single break has developed since the pavement was laid, nearly fifteen years ago upon the former street, and about twelve years ago upon Front St.

To sum up the results of these examinations: It was found that the softest of the granites which are used for paving purposes do not crush from expansion if a good uniform grout is used and it is placed in the joint for practically its full depth. But the hardest of the granites will crush from expansion if the grout is not uniformly good and is not uniformly placed for the full depth in all the joints. In other words, these small defects in grouted granite block pavements are not due to hard or soft stone but result from poor workmanship and that alone. The remedy is simple. An even mixture of grout should be used, and this should be made to penetrate the joints uniformly to a depth nowhere less than 3 ins. With such a depth of good 1:1 grout, no blocks were found to have failed by crushing, not even where comparatively soft granite had been used. It is better to mix the grout by machine; and great care should be taken to secure a uniform product, about the consistency of thin cream. Preferably the grout should be delivered from the machine directly into the joints by means of a spout or a hose in order that the sand may not separate out, as is very likely to be the case when wheelbarrows are used. Often the defects are caused by a careless workman occasionally dropping a shovelful of pea gravel in one spot and thus nearly filling the joints at such spot, so that the grout cannot penetrate more than about an inch. Because of this it is usually better to omit the pea stone or gravel entirely. If there is no such material on the street there is no temptation to use too much of it, and thus the work of inspection is simplified.

In conclusion we would say that if potholes develop in your grouted granite block pavement, first look for the trouble in faulty workmanship, and do not blame the stone for something which should be remedied by careful inspection.

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*Paper presented before Section D of the American Association for the Advancement of Science at the Columbus (Ohio) Meeting, Dec. 29, 1915.

†Consulting Engineer, New York, N. Y.

Several Cities of Iowa Have Awarded Large Paving Contracts

Paving contracts aggregating approximately 720,000 sq. yds. have been awarded by a number of cities in Iowa and plans are pending on work which will bring the total amount up to more than 1,000,000 sq. yds., according to a recent report.

Some of the cities and the number of square yards of paving which they contemplate laying are as follows:

Missouri Valley, 28,000; Denison, 75,000; Oakland, 20,000; Clinton, 20,000; Odebolt, 72,000; Creston, 70,000; Monticello, 40,000; Mason City, 150,000; Ames, 20,000; Iowa Falls, 60,000; Jefferson, 50,000; Oelwein, 40,000; Sac City, 40,000; Grundy Center, 40,000; Manchester, 30,000; West Liberty, 25,000.

Amsterdam, Netherlands, Street Paving Costs $5,000,000

According to a report from the United States Consul at Amsterdam, Netherlands, that city has spent approximately $5,000,000 for street paving and has laid a total of about 4,782,804 sq. yds. of pavement of various types.

The work included the laying of 1,315,600 sq. yds. of cobblestone, 3,289,000 sq. yds. of brick, 132,756 sq. yds. of asphalt and 45,448 sq. yds. of wood block.

In the consular report the costs of the various types are given on the basis of square meters, this unit being equal to 1,196 sq. yd. On this basis, cobblestones cost $2.01, brick, 80 cents; asphalt, $2.49, and wood block, $4.82.

COMING MEETINGS

February 28-March 3—American Road Builders' Association.—Thirteenth Annual Convention; Sixth American Good Roads Congress under the auspices of the A. R. B. A., and Seventh National Exhibition of Machinery and Materials Mechanical Hall, Pittsburgh, Pa. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

March 9—Vermont Society of Engineers—Annual meeting, Hotel Vermont, Burlington, Vt. Secretary, George A. Reed, Montpelier, Vt.

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

March 23-24—Florida State Good Roads Association—Convention, St. Augustine, Fla. Secretary, J. P. Clarkson, Jacksonville, Fla.

Snow Removal Conference in New York City

On the evening of March 8, a snow removal conference will be held in the assembly hall of the Automobile Club of America, New York City, under the joint auspices of the Division of Highway Engineers, Arthur H. Blanchard, chairman, and the Division of Municipal Engineers, George W. Tillson, chairman, of the National Highways Association; the Automobile Club of America, Elmer Thompson, secretary; the Citizens' Street Traffic Committee of Greater New York, Robert Grier Cooke, chairman, and the Graduate Course in Highway Engineering of Columbia University.

The conference will be opened at 8.30 P. M. with an illustrated lecture on the subject "Modern Methods of Snow Removal," by William H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa. A series of topics will then be presented for discussion by recognized authorities on snow removal.

The conference is open to all persons interested in economic and efficient methods of snow removal.

MEETING

Tennessee Road Officials' Conference

The first of three conferences of road officials of Tennessee was held at the University of Tennessee at Knoxville, February 15 to 18. Officials of East Tennessee attended. The subjects covered included the construction of macadam and concrete roads, selection of surfacing materials, maintenance, accounting, bond issues, and county management.

Among the speakers were Frank F. Rogers, State Highway Engineer of Michigan; A. M. Nelson, State Highway Engineer of Tennessee; J. J. Murray, Secretary, Tennessee Highway Commission; Dr. L. I. Hewes, U. S. Office of Public Roads; Dr. Joseph Hyde Pratt, Secretary, North Carolina Highway Commission; Professors R. C. Fergus, J. A. Switzer, Charles E. Ferris and C. A. Keffer, University of Tennessee; Z. D. Dunlap, Warren Bros. Co., Boston, Mass.; John S. Crandell, Barrett Co., New York, N. Y.; J. A. Reagan, Loudon County Engineer, and Commissioner Thomas B. King, of Memphis.

A conference for officials of Middle Tennessee was held at Nashville beginning February 22, and a third conference for West Tennessee will begin at Jackson on February 29.

PERSONAL NOTES

Bartholomew Cronon has been appointed Provisional Highway Superintendent of Seneca County, N. Y., with headquarters at Waterloo, N. Y.

W. B. Knickerbocker, President of the Knickerbocker Co., Jackson, Mich., manufacturers of concrete mixers, died recently at the age of 58 years.

John E. Carty has been promoted from Assistant Engineer in the bridge service of Boston, Mass., to be Division Engineer of the bridge and ferry service.

NEWS OF THE TRADE

The Portland Cement Association has removed its headquarters from Philadelphia, Pa., to Chicago, Ill., where offices have been established at 111 West Washington Street.

The United States Asphalt Refining Co., New York, N. Y., has published in booklet form an address on "The Merits of Refined Asphalt Roads," by Leroy M. Law, Chief Chemist of the company.

Schulz & Hodgson, Chicago, Ill., have issued a folder describing the Hall interlocking concrete culvert and detailing the results of tests under pressure. The folder contains numerous half-tone illustrations.

The Expanded Metal Engineering Co., New York, N. Y., has recently issued a booklet regarding the use of Steelcrete mesh in reinforced concrete work. The booklet contains 12 pages and is illustrated with halftones and line engravings.

The Pioneer Asphalt Co., Lawrenceville, Ill., has issued a unique folder descriptive of its product. It is illustrated with photographic reproductions of roads and streets in various parts of the country, the illustrations being pasted in instead of being printed in the usual manner.

A 44-page booklet has been issued by the Continental Public Works Co., New York, N. Y. The publication describes in detail the company's organization and tells of the work done by it on the roads and bridges of the Ashokan Reservoir contract. The booklet is handsomely printed on fine paper and is profusely illustrated.

The F. A. Dunham-Clarin Co., Plainfield, N. J., has been incorporated to carry on the civil engineering and surveying practice formerly conducted by F. A. Dunham, who is President and Treasurer of the new concern. David X. Clarin, who is Vice-President and Secretary, has been associated with Mr. Dunham for a number of years as head engineer.

The Thompson-Graham Co., Nashville, Tenn., has been organized by John Thompson, Jr., formerly Resident Engineer of the Southern Asphalt & Construction Co., and Thomas Graham of the Stone-Graham Co. The company will carry on a contracting and engineering business. The organizers were recently assigned paving contracts by the Southern Asphalt & Construction Co.

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THE PITTSBURGH CONVENTION OF THE A. R. B. A.

Taking into consideration all the factors that determine the value of a road convention and all the conditions under which the meeting at Pittsburgh this week was held, the thirteenth annual convention of the American Road Builders' Association must be pronounced one of the most successful ever held by that organization.

At no previous time in its history has the association held a convention under such circumstances as obtained this year. In past years the meetings have been held in the late fall or early winter. The change in time put into effect this year will doubtless result eventually in largely increased attendances and in more extensive exhibitions, the former because road engineers, officials and contractors can leave their work better than at the former date and the latter because exhibitors will appreciate and take advantage of the opportunity of reaching larger numbers. It was to be expected that at the first meeting held at the new time the attendance would fall below previous records. Additional weight was given to this view by the opposition to the A. R. B. A. from rival organizations and by reason of the short time intervening between the decision to change the time and the date fixed for the meeting. There was available considerably less time than usual for making the necessary preparations and for enlisting the support of those upon whom so much of the success of a meeting of the kind depends.

In spite of these handicaps, however, the attendance was gratifying, not only by reason of the number who registered but also because the attendance was so largely made up of those directly connected with highway work. It is probable that at no other road convention has the registration comprised so large a proportion of highway officials, engineers and contractors.

Another feature of the Pittsburgh convention that was most noteworthy was the unusually large numbers present at the technical sessions. At every one of these there was a large and interested audience that evinced a lively interest in the proceedings. There was little of the usual loss of interest either toward the end of each session or toward the close of the convention. At many of the sessions all the seats were taken, and there was always a noticeable readiness to participate in the discussions. The papers were excellent, as a whole, and there were few absentees among the authors.

The exhibition was both comprehensive and varied and was the subject of much favorable comment by both exhibitors and delegates. The building was well adapted to the display of the materials and machinery shown and the arrangement was such as to give sufficient prominence to each exhibit and at the same time to make a harmonious whole. Many sales were made during the show and a canvass of the exhibitors indicated that, from their point of view, the show was entirely successful.

No summary of the convention would be complete without a reference to the cooperation of the people of Pittsburgh. Through the city government, the Chamber of Commerce and the press, much assistance was given to the management of the convention. The hospitality tendered to the delegates was all that could have been asked and will remain long in the memories of those who were there.

The chief result of the Pittsburgh convention is the demonstration of the pre-eminence of the American Road Builders' Association among road organizations and its prestige and influence in the particular field which it occupies. It has succeeded against very considerable opposition in justifying its claim of being the only organization in the country made up principally of those actually engaged in road and street work and the only one confining its activities to the practical problems of highway work. The Pittsburgh convention has immeasurably strengthened its position and has assured its future growth in influence and prominence. Its officers are to be congratulated upon the success of their efforts.

ROAD WORK AND STREET WORK

In the paper presented by F. C. Pillsbury of the Massachusetts Highway Department at the Pittsburgh convention this week, it was pointed out that until recently city streets and country roads had been considered as belonging in separate classes, but that during the past few years, principally because of the increase in weight and volume of traffic, the main through roads had come to be regarded as requiring practically the same treatment as city streets.

Highway engineers and others familiar with present conditions know this to be true, but there are probably many who do not realize how slight a difference there now is between road building and street paving. This does not mean that country roads, in general, are improved in the same manner as are city streets, but that the engineer in charge of road work and the engineer in charge of street paving are confronted with much the same problems. Certain questions come up more frequently in the work of the road builder than in that of the engineer concerned chiefly with paving operations, and the city engineer is confronted by certain special problems more often than is the builder of country roads. In other words, the difference in their tasks lies largely in the relative amounts of certain kinds of work they are called upon to do.

Every type of roadway surfacing is used in cities and villages in various parts of the country, and, with perhaps the exception of the wood block pavement and the so-called standard sheet asphalt pavement, every pavement or surfacing so far laid in cities has been put down on country roads. Because of this, for work within the area used by vehicles, the problems of the city engineer and the engineer engaged in work on country roads are almost the same except that the latter is less concerned with the provisions that must be made for subsurface structures. Country and city work, on the other hand, differ in that the former does not usually involve curb and sidewalk work, nor is the designer so restricted in establishing locations, grades and widths. Another point of difference is that the engineer is more often free to decide upon the type of surface to be put down on a country road than is his brother engineer in the city, who must often defer to the whims of the owners of abutting property or the wishes of local politicians.

In past years practically all country road work was done by laymen and much city work was under the direction of those who were in no way qualified to carry it on. The roads and streets so built, while far from satisfactory, stood up fairly well under the traffic they had to carry. With the advent of the motor-driven vehicle, however, the inadequacy of unscientific, rule-of-thumb methods became more and more apparent and there began to grow a realization—until then lacking even to some extent among engineers—that the construction and maintenance of roads and streets is not a work for amateurs but is an undertaking that requires certain knowledge and skill—in short, that it is engineering. This was first realized in connection with city work and it was not until within a comparatively few years that similar special knowledge was recognized as a requisite qualification for the road builder.

Even now, when highway work of all kinds demands so much engineering skill, so wide a knowledge of materials and such sound judgment in the application of fundamental principles, the highway engineer is not accorded the position he should hold. We believe, however, that conditions are all the time improving, and that in the not far distant future all highway work of importance will be done under the direction of highway engineers.

DEFINITE SPECIFICATIONS

"A Contractor's Suggestion to Engineers and Inspectors," a paper presented by John H. Gordon, a well-known road contractor of Albany, N. Y., at the A. R. B. A. convention at Pittsburgh this week, should be read by every engineer and inspector engaged in road work and especially by those engineers whose duties include the drawing of specifications. The paper is printed on other pages of this issue.

Every engineer knows the difficulties and vexations of enforcing compliance with the average specifications, but not every one has a clear conception of the contractor's point of view. Mr. Gordon's paper gives this point of view in a most excellent manner.

It seems obvious that the minimum requirement of a specification is that it should be specific; yet lack of that most essential requisite is one of the chief faults of specifications as ordinarily written. Too much that is supposedly covered is stated loosely and too much is left to the judgment of the inspector or engineer. Very often the engineer who supervises the work is not the author of the specifications and does not really know exactly what they mean. The contractor does not know either, and is very likely to interpret them differently from the engineer. In such cases an honest difference of opinion between the engineer and the contractor is quite possible and, if there is even the slightest lack of accord a serious disagreement often follows, to the detriment of the work.

There has always been more or less antagonism between the engineer and the contractor, and while we believe that this is gradually being superseded by a better understanding, it still too frequently exists. Much of this lack of accord is due to ambiguity in the specifications and could be eliminated, or at least materially reduced, by making every clause clear and specific.

New Legislation Recommended by the Iowa State Highway Commission includes an adequate patrol system of road maintenance, provision for financing road and bridge improvement, provision for state aid, provision for taking advantage of federal aid, provision for using convict labor, motor traffic regulation, and the prohibiting of the use of public highways for high tension electric transmission lines, according to the "Service Bulletin" of the commission. The patrol system is declared to be absolutely necessary to insure the proper upkeep of the roads and to be especially desirable for Iowa roads which carry only natural soil, sand-clay or gravel surfacings. A provision for financing road and bridge improvement is necessary because in the majority of the counties a large proportion of the road fund is required for repair work and, therefore, some system of bonding must be provided to produce the necessary funds to carry on permanent road and bridge work as rapidly as desirable. In reference to state aid, it is pointed out that every state which is making decided advances in the building of permanent roads is doing so by some form of state aid. The commission believes that the automobile license fund in Iowa should be set aside and used only for permanent improvement of the roads. The best use that can be made of convict labor in Iowa, it is stated, is in the preparation of road materials in quarries or in the manufacture of paving brick or similar material. The motor traffic regulation recommended is the adoption of a set of regulations similar to those adopted by the state of Ohio.

A Concrete Pavement Tamped by Rolling

BY. P. EDWIN CLARK*

In 1914, the Board of Trustees of the village of Ellenville, N. Y., authorized the construction of curbs and pavement on Canal Street, between Main and Market Streets. Concrete curbs and concrete pavement were decided upon. A survey, plan and profile were accordingly ordered, not only for the block to be improved, but for a distance of 2,900 ft., taking in several blocks at each end.

The plan for this first improvement called for a curb having a 12-in. base, top of 6 ins. and depth of 18 ins., the face of the curb having a batter of ¼ in. per in.

The concrete was mixed in the following proportions: one part of Atlas Portland cement, two parts of clean, well graded sand, and four parts of crushed quartz rock, known as Shawangunk grit, sometimes called conglomerate. The stone was crusher run, passing through a screen having holes ¾ in. in diameter. The quarry being clear of earth, it was found possible to use the entire product. The curb was cast in Hotchkiss metal forms and blocked off in sections 5 ft. in length, the division plates being drawn so as to leave a clean cut between each section. The top of the curb was finished as soon as possible, and the face of the curb floated with a wooden float, using a mixture consisting of one part cement and two parts screened sand, used only in such quantity as to bring the face of curb to a good smooth surface. The outside top edge was rounded to a radius of ½ in.

At all street corners the returns were constructed on an 8-ft. radius, and all alley returns with a radius of 30 ins. Both street and alley returns were fitted with Wainwright galvanized steel reinforcing bars, size No. 1. Specially constructed wooden forms were used for these returns; the street returns were cast the full length of the return and not divided into 5-ft. blocks.

Canal Street in the early days was known as a turnpike or planked road, and proof of this was found while excavating for the subgrade. For almost the entire length of the pavement the old stringers were found, all rotted, with one exception, which was a piece of hemlock 3 by 6 ins. and about 20 ft. long. All of one end and about one-half of the other was in excellent state of preservation. Upon inquiry, it was found that the last of these stringers had been placed in the road about sixty years ago.

The subgrade consisted of hard water worn cobbles and gravel containing sufficient earth so that when rolled with a 10-ton gasoline roller the foundation held its shape without rutting when the teams delivered the crushed stone, sand and cement. While rolling the subgrade, water from the fire hydrants was used to assist in compacting it. After rolling, the subgrade was checked, all depressions filled and high spots trimmed off; then rolled again, so as to compact the filled-in material.

CONCRETE PAVEMENT ON CANAL STREET, ELLENVILLE, N. Y.—VIEW LOOKING WEST—PHOTOGRAPH TAKEN ONE MONTH AFTER COMPLETION OF PAVING.

The first section consisting of 600 lin. ft. of pavement was laid from Sept. 25 to Oct. 10, 1914, a "Wonder 10" concrete mixer being used for both curb and pavement. The concrete pavement was laid in one course and to a depth of 6 ins., the subgrade being parallel with the finished pavement. A crown of 0.42 ft. was carried from the beginning at Sta. 1+20, for a distance of 510 ft., to Sta. 6+30, and then gradually increased to 0.50 ft. at the end of the pavement or Sta. 7+20. This increase in crown was found necessary, as on the high side of the street there was a very wide cement walk and a concrete curb, too extensive and too expensive to alter or replace in a small village. On the other side of the street where no curb existed, there were stores, built apparently without thought to future road improvements. This condition required the new curb to be kept low enough to provide proper drainage from the floor level at the building line to the curb. The width between curbs varied from 35 ft. to 32.58 ft.

The concrete was mixed in the proportion of one part Atlas Portland cement, two parts clean, well graded sand and four parts of crushed stone, crusher run, passing a screen with holes 1½ ins. in diameter. Forms were set from curb to curb at right angles to the center line and 15 ft. apart. Strips of the Barber Asphalt Company's Genasco expansion joint filler, ⅜ in. thick, were used between the curb and pavement. This filler was placed against the curb with the top of the filler on the grade line and held in place until sufficient concrete had been dumped to keep it from being displaced. The concrete was placed starting from one side of the road and working across to the opposite curb.

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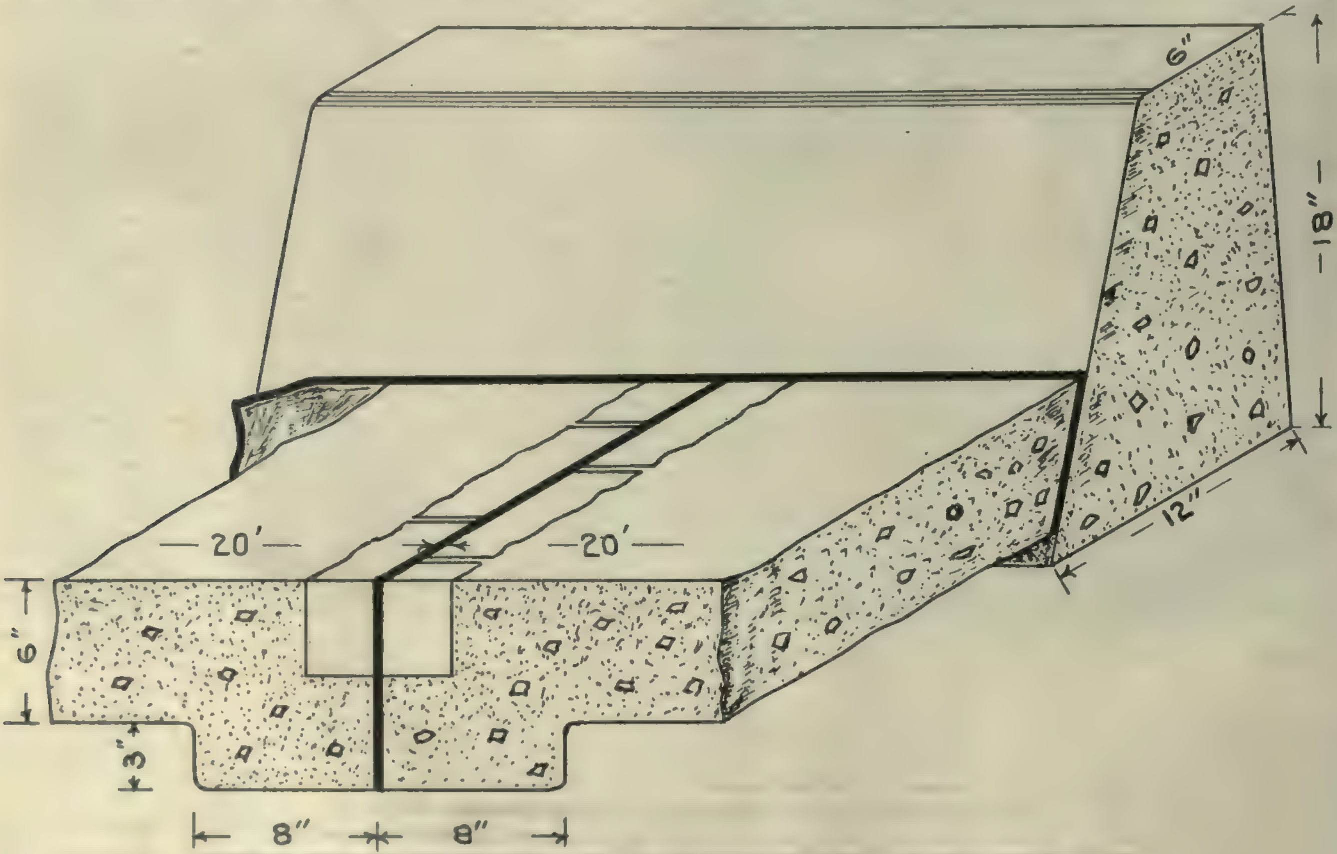
*Civil Engineer, Ellenville, N. Y.

Instead of the ordinary method of hand tamping, a roller was used. This roller consisted of a pipe, 3 ins. in inside diameter and 16 ft. long, filled with dry sand to give it additional weight. Each end of the pipe was fitted with a long, hard wood plug (made of maple), turned in a lathe so as to give a close fit. The outside end of the plug was grooved and fitted with a handle made of ⅝-in. round iron.

The concrete was dumped from wheelbarrows, one man spreading it, using a long handled shovel for that purpose. As fast as spread, it was thoroughly rolled with the pipe roller, worked by two men, one at each end.

It was found that by continuous rolling for a short time, all air bubbles were forced out as well as all excess water, which was carried ahead. This was accomplished by rolling back and forth across the pavement and at different times lifting the roller clear of the concrete, carrying it back to the curb and then rolling toward the concrete last placed. This kept all of the excess water away from the curb and mixed it with the freshly dumped batch. As soon as the concrete had set, sand was spread over the top to a depth of about 1 in. and kept thoroughly wet for 10 days then allowed to dry out. The result of this method is a very solid and practically impervious pavement.



SECTION THROUGH PAVEMENT AND ELEVATION OF CURB AT EXPANSION JOINT.

Transverse expansion joints were left every 30 ft. As soon as two 15-ft. sections were filled with concrete, the middle form was removed, the opening well grouted, tamped and floated by hand. The upper end form was left in place until the whole section of 30 ft. was finished. When it was removed, Genasco expansion joint filler was set in line and protected by a row of Dunn wire-cut-lug bricks on each side. These bricks were made by the Sterling Brick Co., of Olean, N. Y.

The bricks were laid with the smooth side next the filler, and thoroughly grouted, using the same mixture used for the pavement, but with the stone screened out. Under all of the transverse joints for a distance of at least 8 ins. on each side, and a depth of 3 ins. below the subgrade, an additional thickness of concrete was placed. This construction is shown in the accompanying sketch.

This first 600-ft. section was contracted for by the village which furnished and delivered all materials, consisting of sand, stone, cement, reinforcing bars for curb, asphalt filler and brick, making all excavation and preparing the subgrade to receive the pavement. The Thomson-Wooster Contracting Co., of Walden, N. Y., furnished all tools, forms, mixer and labor on the following basis: Pavement, 45 cts. per sq. yd.; curb, 30 cts. per lin. ft.

The second section of this pavement was continued from Sta. 7+20 to Sta. 15+60. This section was built by local talent. The contractor, Jacob Weber, was the lowest bidder and commenced work in April, 1915. The village furnished all material and the use of a 10-ton gasoline roller, the contractor furnishing the fuel and the engineer to operate the roller.

The excavation for this work was made by the contractor who bid 58 cts. per cu. yd. for all excavation measured in place, including rolling and bringing the subgrade to its required shape; 30 cts. per sq. yd. for concrete pavement, and 30 cts. per lin. ft. for curb.

The construction was the same as in the first contract, except that the sections were 20 ft. in length instead of 15 ft., the transverse expansion joints, protected by Dunn wire-cut-lug brick, being placed 20 ft. apart instead of every 30 ft. as in the first contract.

The pipe roller used was 22 ft. long, 3½ ins. inside diameter, and filled with sand. Lehigh Portland cement was used in this section, the proportion of sand, stone and

TEARING UP OLD ROADBED WITH ROOTER PLOW AND ROLLER—ELLENVILLE, N. Y.

cement remaining the same as that used in the first section for both curb and pavement. A Standard gasoline-driven concrete mixer was used for the pavement, while the concrete for the curb was hand mixed. The width between curbs varied from 34.70 to 36.00 ft., the latter width continuing from Sta. 7+80 to Sta. 15+60. In tearing up the old roadbed, a rooter plow was used, power being furnished by the gasoline roller.

The quantities and cost of the second contract were as follows:

Excavating and grading 1,491.13 cu. yds. at 58 cts....	$864.85
Cement, 902½ bbls., at $1.05 net..........................	947.62
Sand, including sand used for protecting pavement, 287 cu. yds., at 54 cents..................................	154.98
Stone at crusher, 515¼ cu. yds., at $1.925..............	991.86
Stone, loading and hauling, 515¼ cu. yds., at 60 cents..	309.15
Pavement 3,315.67 sq. yds., at 30 cents, per sq. yd......	994.70
Curb, 1,562.39 lin. ft., at 30 cts. per lin. ft............	468.71
Engineering, inspection and assessment list..........	413.46
Genasco expansion joint filler	105.41
Dunn wire-cut-lug brick, delivered and piled opposite each joint, 4,200 brick	126.00
Wainwright curb reinforcing bars	48.34
	$5,425.08
Deducting cost of curb	928.66
Total cost of 3,315.67 sq. yds. pavement..............	$4,496.42
Making the cost $1.36 per sq. yd.	

It will be noted that the cost of crushed stone on this job was high. This was due principally to unsatisfactory steam drills, poor facilities for transporting rock from quarry face to crusher, and inadequate storage facilities.

The cross section used on this street was a combination of curve and plane, which we will call a tangent, the crown consisting of a short curve 15 ft. in length and the tangent on each side varying in length according to the height of the opposite gutter. Where both gutters were of the same elevation, the center of the curving crown was in the center of the street, with equal tangents on each side, but when one gutter was higher than the other the crown approached the high side giving one short and one long tangent. The cross sections were calculated as follows:

PLACING AND ROLLING CONCRETE—PIPE ROLLER SHOWN AT LEFT OF ILLUSTRATION.

Where S = slope of the tangents, D = difference in elevation of opposite gutters, W = width between gutters, C = crown, EC = distance from center line between gutters to the center of the curving crown, B = width of curving crown, Y = difference in elevation between center and end of curving crown, X = horizontal distance from center of curving crown to end of tangent at high gutter, X^1 = horizontal distance from center of curving crown to end of tangent at low gutter, L = difference in elevation between center of curving crown and low gutter, H = difference in elevation between center of curving crown and high gutter.

$$S = \frac{4C}{2W - B} \qquad EC = \frac{D}{2S} \qquad Y = \frac{SB}{4}$$

$$X = \frac{W}{2} - EC \qquad X^1 = \frac{W}{2} + EC$$

$$H = S\left(X - \frac{B}{4}\right) \qquad L = S\left(X^1 - \frac{B}{4}\right)$$

This form of cross section consisting of a curve and tangents is well adapted for a street that has to convey the storm water for its entire length, receiving the drainage from points midway of all intersecting streets, and having the curb on one side of the street higher than the other for a considerable distance, which necessitates a tilted cross section. The heigth of curb was established at 10½ ins. This was done in order to provide for future repair or improvement, to consist of a brick pavement to be laid upon the worn-out concrete surface. By using the present concrete for a subbase and putting in a cement filler under the brick instead of sand, a new pavement would be secured at a small cost.

ROLLING CONCRETE AND PLACING BRICK ALONG EXPANSION JOINT.

The pavement laid under the first contract has had one year's wear, consisting of mixed traffic, both heavy and light, automobiles and teams. It is to be noted that under these conditions the pavement as yet shows no sign of wear. Some of the 30-ft. sections show a slight straight-line crack where the 15-ft. form was removed, while in other sections no cracks or any other lines have so far appeared.

Work During the Coming Season in Will County, Illinois, will include the expenditure of about $35 000 for concrete road construction. An 18-ft. concrete pavement will be laid on Archer Road between the Cook County line and the city limits of Lockport. This will be state aid work and will connect with the Archer Ave. state road in Cook County. The Board of Supervisors of the county also plans to purchase two more outfits for building and repairing roads. The county already has one such outfit in service. One of the outfits to be purchased will consist of a tractor and a large grader for earth road work. The Board of Supervisors has also passed a resolution to aid Jackson Township in the construction of a concrete bridge which will cost about $8,000. According to Will H. Smith, County Superintendent of Highways, it has not yet been decided whether the bridge will be of the arch or the girder type.

Street Cleaning in Cleveland, Ohio

In a paper entitled "The Street Cleaning Problem," presented at the recent road congress at Worcester, Mass., by Gus. H. Hanna, who until recently was Commissioner of Street Cleaning of Cleveland, Ohio, the work of street cleaning in general was discussed at some length and data were given on costs in the city of Cleveland. The outstanding feature of the paper was the emphasis laid on the necessity of including the cost of cleaning in the consideration of the economy of various pavements.

The three elements of economy in street cleaning, according to Mr. Hanna, are the methods employed in cleaning, the methods of reducing litter and the consideration given the cost of cleaning in the paving policy.

Experience in Cleveland, according to Mr. Hanna, has proved that flusher cleaning is not only the cheapest but the most satisfactory method of street cleaning. Hand sweeping is used in that city to a considerable extent and the "white wing" cannot be wholly done away with under any conditions, as downtown streets must be swept continuously during the day and the gutters of residence streets must be kept clean. Statistics of the Cleveland department, however, show an average cost of 15.3 cts. per 10,000 sq. ft. for flushing, to which must be added practically 9 cts. for pick-up work, making a total unit cost of about 24 cts., as against 42 cts. for the work of white wings. One of the advantages of flusher cleaning is that it does not raise dust as does sweeping. The water, however, should always be applied with sufficient force to carry the refuse to the gutters, from which it should be promptly collected with brooms and shovels and then removed.

The prevention of litter, as stated in the paper, has perhaps been carried further in more congested cities than it has been necessary to carry it in Cleveland. Even in the most crowded quarters of that city, garbage or ash cans are seldom placed on the sidewalks, so that one cause of dirt and litter is reduced to the minimum. Reasonable success also attends the efforts of the Street Cleaning Department to teach the public to use waste paper boxes. In this connection, it is pointed out that nothing encourages carefulness on the part of the public so much as efficient and careful cleaning. While a man does not hesitate to throw paper or rubbish into an unclean street, he hesitates if the street is clean; and if there is a waste paper box at hand he is apt to use it.

One of the most expensive areas to clean in Cleveland has been a space of a few hundred feet near a certain street corner where a curb market is situated. This is supposedly a farmers' market, but is really the resort of professional hucksters who sell more or less damaged provisions obtained from adjacent market houses. It cost the department $10,000 to keep this area clean during the past year, and it was recommended in the paper that some method be found of doing away with the nuisance.

In discussing the cost of cleaning different kinds of pavements, Mr. Hanna stated that it was a continual wonder to him that so little weight was given to cleaning costs in settling paving questions. He pointed out that an annual expenditure of $500 per mile for repairing a residence street would be considered an appreciable item of maintenance but that that figure for cleaning a mile of residence street during a season would be extremely low. An annual cost of $500 per mile for maintaining one kind of pavement as against a cost of $1,500 for maintaining another kind would be sufficient ground in most cases to decide in favor of the former, yet greater differences than this in cleaning costs as between different types are overlooked.

Two qualities are essential in a pavement for easy cleaning, according to Mr. Hanna. It must be smooth, and

WEST 14TH ST., CLEVELAND, OHIO.—GROUTED BRICK PAVEMENT CLEANED FIVE TIMES WEEKLY AT A COST OF ABOUT 15 CTS. PER 10,000 SQ. YDS. PER CLEANING.

particles of litter must not stick to the surface. Smoothness is influenced largely by durability, as a material that deteriorates and roughens becomes each year more difficult to clean. Bituminous pavements, according to Mr. Hanna, are more expensive to clean than others on account of their sticky surfaces to which particles of litter adhere, while the pavements most easily cleaned are brick and stone, neither of which originates dirt and both of which are readily washed. The cost of cleaning such pavements is influenced largely by the kind of filler employed, a bituminous filler having, from the street cleaner's standpoint, all the disadvantages of a bituminous surface. In addition, according to Mr. Hanna, it recedes, leaving crevices in which dirt lodges.

As an example of the cost of cleaning brick streets, Mr. Hanna cited the case of West 14th St., a grouted brick pavement 10 years old. The street, it was stated, carries a traffic of about two vehicles a minute and is cleaned, on the average, five times a week, being flushed at night and hand swept during the day, the sweeper working almost exclusively in the gutters. The cost of cleaning has been about 15 cts. per 10,000 sq. ft., this area in Cleveland being termed a "square" and used as the unit for calculating street cleaning costs. This, according to Mr. Hanna, is the lowest cost that has been achieved on any type of pavement.

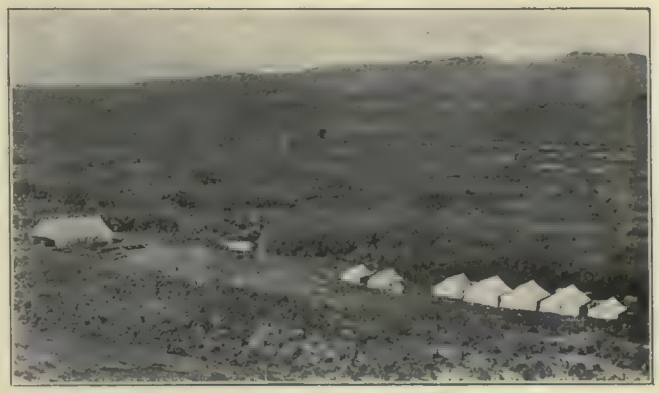
Discussing further the relative costs of cleaning different kinds of pavements, it is pointed out that between a street that can be cleaned for 15 cts. and one that can be cleaned for 30 cts. there is a difference of $3.15 per mile per cleaning, a difference of $15.75 per week, or a difference of $630 per season of 40 weeks. This would make a total cost in 10 years of $6,300. In the case of a pavement which would cost 60 cts.—which, according to Mr. Hanna, is not uncommon—the yearly cost for cleaning would be $1,890 as against $630 for the pavement which could be cleaned for 30 cts. per square and in 10 years the excess cost would be $18,900.

Road Work in Power County, Idaho

By CLEMENT WHITE

In highway district No. 1 of Power County, Idaho, $125,000 is to be expended for the construction of about 150 miles of road. Work was commenced in March of last year and up to Aug. 20 about 70 miles of road had been built and about $50,000 had been expended.

The work is being done by the county, which employs an engineer to supervise the work and also boards the laborers. From 75 to 200 men are employed in the various crews, each of which works under the supervision of a competent foreman. Laborers are paid $2.50 per day and the price for a team and driver is $5.00 a day.


ROAD CAMP, POWER COUNTY, IDAHO

The roads being built are of earth, well graded and drained and usually crowned about 1 in. per ft. The maximum grade is 6 per cent. Where the ground is fairly level road graders are used for cutting and filling and for shaping the roadbed. Where the cutting and filling are heavier plows and scrapers are used for grading. Material is moved by graders at about one-half of the cost for an equal amount handled by plows and scrapers.

Included in the work is the building of a number of bridges. These are mostly of concrete and are put up under the specifications of the State Highway Department.

As soon as a section of road is completed adequate provisions are made for its maintenance. The county officials have found dragging the most effective method of keeping the earth roads in good condition and this work is done by contract. The county is situated in a semi-arid region where, on account of soil conditions, a well drained road dries out very quickly after a rain. For this reason an efficient organization and competent supervision are necessary in order to insure the dragging of the roads while they are moist. Contracts are let for dragging certain specified lengths of road at a stipulated price per mile per season. The average cost is approximately $10 per mile annually.

The County Council of Marion County, Ind., has decided to join Indianapolis, Ind., in the construction of two bridges. The county's share of the expense will amount to about $125,000.

Improvements to the Rockyfork River at Mansfield, O., will cost approximately $100,000, according to preliminary estimates. It will be necessary to replace all bridges.

A ROAD BUILDING CREW AND CAMP IN POWER COUNTY, IDAHO

Papers Presented at the Thirteenth Annual Convention of the American Road Builders' Association

Note: The following papers include those which space permits printing in this issue. The remaining papers will be printed in "Good Roads" for April 1.

The Adaptability of Road Paving Materials to Different Conditions and Localities

By F. C. PILLSBURY
Division Engineer, Massachusetts Highway Commission

The adaptability of road paving materials to different conditions and localities when thoroughly considered embraces a very wide field. The subject, if taken literally, does not permit limitations, and I assume it is desired to be as comprehensive as possible. It should be borne in mind that few, even of the highest authorities, have had actual and thorough personal practice and experience except within more or less limited territory, and on this account it is well to emphasize that the practice which might be excellent in one locality would fail at some other place.

The pavement or surface of the road, to be thorough in the consideration of this subject, must be considered as the whole of that portion of the road which is, artificial or natural as the case may be, to its full depth, serving the purpose of carrying the traffic. It is not safe to attempt to decide upon the selection of any wearing surface without giving due consideration to those parts lying immediately beneath, and which are generally termed, (1) the base or bottom course, and (2) the subbase or foundation, also to the nature of the ground upon which the whole is to rest.

The selection of pavements and road surfaces is a subject which has been fully and ably covered a number of times, so there is little to add that will be of interest unless it is taken up from a different point of view, which may be done by considering in an elementary way some of the rudiments and their general applications, under different conditions and in different localities. These conditions may be classified under the following two headings which seem to represent the predominant factors—climate, including its principal conditions of temperature and moisture, and traffic.

The climatic conditions at all times affect all kinds of surfaces. The effects are exceedingly various and not due to, nor are they to be measured by, the changes in temperature or moisture alone, but also according to the traffic and the nature and qualities of the kinds of materials used. A high temperature has a tendency to soften bituminous materials; a low temperature to make them brittle, with a tendency to break. Moisture becomes absorbed, thus causing expansion, while high temperatures as well as extremely low temperatures increase this result, and medium low temperatures generally cause contraction. In some materials these physical changes become very serious, frequently causing destruction when not taken into account. The chemical conditions following the changes of climate are usually so indefinite and of such slight consequence that they need seldom be taken into consideration. Materials should be of such nature as to carry the traffic with the minimum effect of these climatic changes. Some surfaces would be satisfactory in certain climates and would fail in others. Certain materials might be used in one climate and would fail utterly under similar conditions in another climate, while the same type of pavement made of exactly the same material to answer similar requirements would be successful if constructed by different designs, taking into account the effect of the climate. For instance, the thickness of certain types of pavement should be much greater when subject to frost than in climates where there is practically no freezing.

The necessity of providing for the requirements of traffic is imperative and the materials which will sustain traffic in a hot climate may not answer in a cold climate, and vice versa, although certain materials may be so manufactured and so used that the changes of climate will have very little effect upon them. These include stone block, wood block, brick, broken stone, and other minerals of more or less solid nature as well as some bitumens, these latter, however, acting like Portland cement as cement or binder. Portland cement concrete is apt to break up from expansion and contraction following extremes of wet and dry or heat and cold. Asphalts and bitumens should have a very low penetration, that is, be quite well solidified when used as a cement or binder in warm climates, otherwise they become softened under a high degree of temperature. This is always to be considered, to a certain extent, in any climate. Bitumens should never be of such a nature or quality as to become brittle when cold. Certain asphalts are less likely to be affected this way by low temperature than others, and probably nearly all of them might be prepared so as to retain the necessary degree of plasticity when cold, at the same time having sufficient stiffness when subject to a high temperature. Certain proprietary and patented compositions, consisting mainly of matter with which it is necessary to use bitumen, are as little affected by changes in temperature as the very best asphalts, but on the other hand they are probably readily affected by moisture.

While there are certain other requisites such as those related to hygiene and aesthetics, these are not usually necessary requisites, inasmuch as they do not have to be provided for in determining the choice of materials, except as secondary considerations. Nearly all first class pavements and road surfaces can be easily made sanitary, practically dustless, and reasonably free from mud, and will remain so if properly designed and cared for, considering traffic and natural conditions only. Aesthetic requirements are related usually to park systems and private roads, although they should not be forgotten in connection with public highways. They are almost always satisfied by the results obtained from an excellent surface and the surroundings of the road, such as tree planting, roadsides, etc. Noise, however, depends directly upon the kind of traffic and cannot always be easily overcome. There is little excuse for the very rough and uneven stone pavements which exist in many of our cities. Stone pavements can be so constructed and maintained as not to be seriously noisy, and the tendency is toward smoother pavements. Noise is a serious consideration in cities and should always be avoided so far as possible, but in these days of mechanical vehicles there seems to be more of an opportunity to overcome noise in the vehicle itself due to the condition of the vehicle rather than the condition of the street. There is another condition, but this is related more directly to traffic, and that is non-slipperiness for horses. While this is also a secondary consideration except in extreme cases and on steep grades, it should ever be kept in mind and both design and materials be provided to reduce the slipperiness to a minimum. It can be overcome to some extent by the reduction of grades and flattening of cross sections, also banking curves. The entire elimination of slipperiness cannot be accomplished without extraordinary cost, except on those roads subject to very light traffic or in warm climates. It would seem unreasonable to attempt to overcome, in the design or choice of material, the occasional slipperiness due to icing of the surface. It is possible by sanding and frequent cleaning, when the grades and cross sections are suitable, to reduce the slipperiness to a reasonable state. It would be possible to construct bituminous pavements with surfaces so rough that they would not be slippery, but such surfaces, on account of their roughness, would be subject to those forces which naturally result in wear and would lead to abnormally rapid destruction.

There are so many known materials adapted for use in paving road surfaces that they are almost numberless. If this be true of those materials that are known, how many must there be that are unknown! This vastness in variety, however, seldom applies to a selection in any given locality. Usually the problem is not an extremely difficult one for an experienced engineer provided he is not limited unreasonably by the local demand, financially, or in other ways. The writer has observed that the highway laws in the United States are generally so imperfect and the highway organizations of the various communities in the states so irregular and incomplete, that many times wisdom is not displayed in the selection of types of pavement and materials with other matters relating to the same. The development of this whole question has been so rapid and it is continuing to develop so extensively that the general public as well as many of those actually engaged in the work have failed to realize the changes that are demanded in almost every way. This condition is not surprising, but is to be expected. Much can and should be done to increase the knowledge of those upon whom the work will fall, as well as the general public.

In the question of the selection of materials, as far as they are influenced by these main considerations, it matters little, as to the quality of material or actual design of the pavement, whether the location is in the country or in the city. These variations in location should be subject to the same methods of treatment, in providing for the effects of traffic and climate, all other requisites, of course, being taken into due consideration.

It is a coincidence worth remarking that road pavements are with few exceptions composed of materials taken directly from the earth, usually without great change in composition, and used for a purpose that requires their being placed back again on the earth, and hence to a degree are subject to the effects of the same natural forces as before their removal from the earth. When exposed to the weather, as road surfaces are exposed, the effects of natural phenomena on these materials are greatest. It has been said, and truly, I believe, that the wear of a road surface might be one half due to the effects of weather and one half due to traffic. The weather, through which climate is mainly evident, is working all the time, and almost always for the deterioration of the road surface. This is not always given due consideration. Having in mind as far as practicable all these requisites and conditions, the writer gives the following list of natural materials, together with some of their common uses, but he believes the competent road designer should be able to go still further and invent—if that word is not an improper one to use in this connection—new combinations or methods which it will often be found advantageous to adopt.

It is not practicable to enumerate here all the different materials, but almost all, and enough for the purposes of this paper, are included in the following:

Loam, by which is meant that fertile covering of most portions of the earth, composed principally of clay, fine particles of sand, and vegetable matter; sand, including all so-called sands, from the finest to those in which there are no particles over ¼ in. in size; gravel, meaning masses composed of fragments of rock loosely mixed with more or less sand and sometimes including a small quantity of loam or clay, the particles of rock being either worn smooth and round or of any form to that sharply angular, often more or less coated with clay or marl, but never compacted so closely and firmly in a solid mass as to be confused with bowlder clay or the hardpans; clay, including pure, fine clays, marls, and earth consisting of more or less clay, found in dense and compact masses with fragments of rock of any size, including bowlder clay and clay hardpan; stone or rock, meaning all kinds of stone materials, not including those minerals classified as sand, gravel, clay, etc., and any ledges, bowlders or stones when separate from masses of clay or gravel; bitumens, including asphalts, oils and tars; wood; and shells.

At the present time these natural materials are used in many ways and in innumerable combinations. There is unlimited opportunity for development in use and composition, even to the extent of the discovery of some method or material or combinations of the same absolutely new, and perhaps possessing certain qualities that would accomplish more of the results required than any material in existence at present.

The more common uses of these materials are so well known that it is unwise to include many of them in a paper of this kind, but it may not be uninteresting to discuss those cases which are connected with conditions which should govern the selection and which are sometimes in dispute or not generally known or perhaps not recognized as being of importance. This the writer will endeavor to do, taking up the subjects in terms of the natural materials and others, as already defined, and considering not only their fitness, but dangers to be avoided when improperly used or allowed to remain in risky positions.

Loam or loamy material is seldom of value, particularly in climates subject to much moisture or cold. In these climates, however, it is sometimes used as a binder under certain conditions with sand, gravel or broken stone and with bituminous mixtures. Even this use is to be avoided when the cost of other materials which would answer the purpose is not prohibitive, because the value of the loam lies alone in the fineness of its particles, which enables it to act as a filler. It is so quickly acted upon by moisture, frost, wind, etc., that it has practically no stability. In climates subject to frost action, except where it is very slight, loam should be eliminated as much as possible from use in the pavement material and should not be allowed to remain in its natural position in the roadbed within less than 12 ins. of the bottom of the base unless the road is to be subject to very light traffic, because its instability and tendency to decompose cause the surfacing above to become driven out of place and broken up. A macadam, either water bound or bituminous, is more disastrously affected in this way than gravel, as the gravel surface is somewhat loose and is not ruined even if it does go out of place, whereas the crust-like formation of macadam or bituminous surfaces is liable to breaking and to greater difficulty in restoring afterward. Loamy materials readily absorb, and generally after absorption retain for a long time, moisture which when present in great quantity leads to tremendous expansion on freezing. This becomes a very destructive condition, under any pavement, and if it is not possible or expedient to avoid placing the pavement on or too near the loam, every possible means should be taken to keep the water out of it.

Sand, in its natural condition is very seldom adapted to use on any kind of road surface unless used with some other material or as an auxiliary for the aid or relief of some kind of surface. Most sands, even those that are very fine, have qualities which make such use desirable. The fact has been well established that the particles of sand, when used in any bituminous or cement mixture for road purposes, should have a certain gradation from coarse to fine in order to obtain the greatest strength and other qualities necessary for superior endurance of the pavement. It has been found that even the loose sand of Cape Cod can be used without grading or the addition of other materials, except asphalt or asphaltic oil or tar, to give very practical results for country roads even when subject to considerable traffic and some heavy teaming, provided there is excellent drainage, particularly of the subsoil. This type of pavement, in the work done with the Cape Cod sands, is but an approximation of sheet asphalt, the difference being between extreme care taken to obtain sands of proper size, form and quality, and perfectly adapted asphalt for the sheet asphalt work, and the absence of any particular care except in the quality of the bitumen. Excellent results from sands are obtained when used in mixtures of other kinds, with gravel or broken stone. Experience has proved the advantage of using sand as a binder in laying water bound macadam under certain conditions; also for stopping or arresting the ravelling of water bound macadam. Its use with blanket or film coats of bitumen is well known. It frequently happens that bituminous macadam commences to break up under traffic from the effect of moisture and frost or moisture alone, and the prompt application of a layer of sand an inch or more in thickness over such spots prevents their breaking up. Fine loamy sands, quicksands, or others which absorb and hold moisture should be carefully avoided in the foundation, as their presence when too near the surface will lead to its destruction sooner or later. In such cases the same precautions and methods should be used in the foundations as when loam or clay is present. The sand-clay roads are also well known, but they are of little value in climates where frost action obtains. Sand is so various in its composition and formation and the results so various that unless its qualities are well known a careful study and analysis should be made before using in any important work. The use of sand not qualified for the desired purpose may lead to failure, particularly in high grade bituminous and Portland cement mixtures.

Gravel occurs in such a multiplicity of forms and compositions that it is impossible in a paper of this kind to cover its use. Unless composed of rock which is too soft, or containing too much fine material, it is very valuable as a paving material and may be used in many different ways and for all kinds of traffic except that of extremely heavy weight. Its presence in the subgrade is desirable, and it may be used to advantage in most foundations, being better adapted for that purpose on extremely soft, moist soils, such as quicksand, loam, etc., than stones or telford. Its excellent qualities, however, frequently lead to its use where traffic conditions are too severe.

Clay, in its natural state, is of about as little value for road purposes as anything except loam. Its presence will generally lead to the failure of any surface that may be laid directly upon it, except in climates free from frost and surfaces subject to extremely light traffic. The writer considers that pavement a failure which does not carry the traffic for which it is designed, at a cost of construction and maintenance that is not at a minimum, although he realizes that there may be times when the financial condition of the community makes it necessary to adopt a surface that will not be satisfactory in those respects. The use of clay in the form of brick, while very successful from every point of view, under proper conditions, has failed sometimes for extrinsic reasons. It is essential that a brick pavement should be laid upon a stable base, especially in those climates subject to frost action. It should not be used under very heavy steel tire traffic. The writer has known of brick pavements being severely criticised when the fault did not lie in the brick, but when it was laid on imperfect foundation, or under unsuitable traffic conditions, or both. It makes an excellent surface for motor vehicles, and need not be slippery for horses. However, the greatest care should always be taken by means of testing to obtain brick of proper quality.

Stone, commonly speaking, is generally used in pavements by the following methods: In foundations, in water bound macadam, bituminous macadam, bituminous and cement concrete and stone block pavements. There is frequently much waste of money in laying stone foundations, as they are often put in where unnecessary, or where clean, stony, or sandy gravel would not only serve the purpose, but to better advantage. This depends of course upon local conditions. The question is constantly arising between a choice of bituminous macadam or concrete and water bound macadam. Almost always the choice depends upon the volume and nature of the traffic. Water bound macadam will not carry any appreciable volume of motor vehicle traffic unless protected on the surface by some bituminous or other treatment, and even then the traffic must be light. Where there is much horse-drawn traffic it is sometimes better to surface with water bound macadam, thus obtaining a surface which is generally less slippery, even if reconstruction is frequently necessary. There is much to be said as to a choice between bituminous macadam and bituminous concrete, but as with most other materials, much depends upon local conditions. There is a wide difference to be obtained in the quality of either of these pavements. This may be due to different methods, and is sure to follow variation in the quality of either the mineral aggregate or the bitumen. In the writer's opinion the local conditions should govern the choice and always the best materials available should be obtained. It is not necessary, beside being dangerous, to copy any set specifications covering these methods, and is impracticable to lay down rules to be followed in making a choice. The natural materials that are most available should be taken and used to the best advantage according to their peculiar qualities. In many cases stone blocks might be used to much better advantage than they are, provided more pains were taken in laying the pavement, as well as in making the blocks. For those reasons many cities are now suffering from rough stone pavements. As stone pavements of good quality are probably the most permanent and will carry the heaviest traffic, they deserve more consideration than they have generally received. There is a difference of opinion as to the wearing quality of certain kinds of stone.

Bituminous pavements provide for all kinds of traffic except the heaviest, by which is meant the extremely heavy traffic to be found in the large cities. Bituminous pavements have been the subject of so much discussion, and their uses are so familiar, that this paper will only mention in a brief way the more common methods, surface treatments and surface compositions, by either the penetration or mixing method. As stated under the use of broken stone, surface treatments of bituminous materials on water bound macadam should only be used when the traffic is light, or where it is extremely desirable to have a good footing for horses, and in such cases where the traffic is at all heavy, it is better not to adopt the blanket coat method, but to use the film coat method, so-called. The choice betwen tars, oils and asphalts is often difficult to make. It is not possible to apply so-called heavy oils or tars except hot and in a blanket coat, as their consistencies are such that a considerable body of material is necessary to keep its place on the surface of the road. The lighter materials, which can be sprayed on cold, to cover the surface in much smaller quantity, will generally give more satisfactory and economical results. This is particularly true of so-called cut-backs or diluted asphalts. There are cases where tars for surface treatment seem to give better results than other materials, and the same may be said of nearly all materials used for surface treatments. Bituminous or other surface applications on macadam or gravel, or even on cement concrete, will never remain long enough to be economical where there is heavy teaming with steel-tired vehicles. Usually sufficient care is not taken in using bituminous materials in penetration or mixed work. Where proper care is taken in selecting the right kind of bitumen, and the right kind of mineral aggregate, and in the workmanship all the way through, bituminous pavements and surfaces should prove more economical than any others for all traffic of the present day, except for that which is very light or very heavy. It may not always be, however, the most desirable, partly on account of slipperiness which sometimes obtains, or local reasons. Its widely diversified qualities permit of its use under many different constructive conditions, and in pavements of very great difference in cost. It enables us to use sands, gravels, and rocks which would be practically worthless alone or with any other material than bitumen. Bituminous pavements have failed because of improper conditions in the base. Bituminous pavements do not fail any more than other kinds of pavements, when laid under suitable conditions, and composed of good bitumen, with the proper mineral aggregate.

The choice of materials also depends somewhat upon the treatment of the foundation. Moisture, with frost action, according to their degrees of intensity, with heavy traffic, usually require the most expensive and strongest pavements. So much depends upon drainage in such cases that where it is possible to obtain deep, open ditches on each side of the road, certain pavements will succeed without artificial foundation where without the side ditches or drains, even the strongest pavement would fail, as for instance, Portland cement concrete, or stone block on a concrete base. For the sake of comparison, consider climates where there is no frost action with that of New England. In countries where there is no frost action it would be extravagant to build the types of road required in New England or similar climates. On the other hand, it is impossible to build such light or thin pavements in New England as could successfully be built in those climates free from frost action, or comparatively so, and to have them withstand the weather conditions.

City streets and the streets of the larger villages until recently were considered in a separate class from country roads, but during the past few years, and principally due to the ever increasing weight and volume of traffic, the main through roads and those connecting the larger centers of population, have come to be recognized as requiring practically the same treatment as city streets. Sometimes this treatment is more costly, as in the case of old highways where the foundations and drainage have to be taken care of, as well as the grades and alignments.

The greatest skill and wisdom is necessary in the reconstruction of old surfaces. There is much difference of opinion, and after all, the selection of materials in any case depends more than any other thing upon the knowledge and judgment of those making the selection. Advantage should be taken of the proximity of any natural materials that may possibly exist. This makes it necessary, if the wisest and most economical selections are to be made, to have a knowledge as wide as possible of all various types of surfaces, and all materials that are used for such purposes, including the materials in their natural state. It is with this in mind that the writer has ventured to discuss in a rudimentary way the simpler applications of the natural materials in their more common uses.

Street Railway Track Construction in Paved Streets

By R. KEITH COMPTON

Importance of Construction.—One of the most difficult problems which a municipal engineer faces in street improvement of today is the premanency of the street railway track construction. On this point hinges the durability and integrity of that portion of the pavement immediately in the railway area and adjacent thereto. Even in outlying suburban sections, pavements on streets where railway tracks exist are more difficult to construct and maintain than on streets where no tracks exist. The situation is intensified when similar streets are to improved in heavy traffic sections of busy cities.

Early History.—The speaker takes the liberty of introducing into this subject his experience in the City of Baltimore, where this matter has been given most careful attention, both by the municipal authorities and the street railway officials. In collecting data on this subject from the principal cities of this country we find that other cities have passed through similar experiences. Some fifteen years ago it was the practice of street railway companies to lay the ties directly on the original earth foundation of the street, tamping up with whatever local material was convenient. Consequently track structures had absolutely no stability other than that given by the natural earth foundation existing in the street, so that within a few months after the street was improved and opened to traffic the rails would vibrate under the movement of cars and heavy trucks, with the result that cracks would develop in the paving adjacent to and for several feet on either side of the rails, causing rapid disintegration of the paving, particularly in the case of sheet asphalt. If the pavement were of stone or vitrified block, cracks would develop and the paving blocks would soon begin to "work" and loosen up. Within twelve months the paving in the railway area would be in such condition as to seriously impair the usefulness of the street. This disintegration did not confine itself to the railway area, but would gradually encroach upon the city area.

The next development in this construction was the installation of gravel ballast. This was somewhat of an improvement over the original construction, the only difference being that the development of cracks and disintegration was somewhat postponed. Gravel, being round and smooth, would shift under the strain of passing traffic, with results most damaging to the paving.

The crushed stone ballast was then used. On suburban streets with light car and vehicular traffic this was a decided improvement, and in some instances the results obtained, both as to track construction and maintenance of paving, were most desirable. Care, however, had to be taken by the track gangs to see that most careful tamping was done. The rock ballast construction, however, in heavy traffic downtown streets, did not give the results desired, so that in the past few years many cities have been installing a concrete slab, from 6 to 8 ins. in depth, under the ties, then brought up and completely enveloping the ties in concrete, and the concrete foundation for the paving installed on top of this.

Right here it may be well to note the following list of cities which have used or are using concrete as a foundation for track construction, in whole or in part. Most municipalities do not use it exclusively, but use concrete in the heavy traffic sections, and rock ballast in the suburban sections where car and vehicular traffic is light, or where the paving of streets may not be regarded as permanent on account of the surrounding property being undeveloped. This information was obtained in 1913 and 1914 through correspondence with municipal officials in the respective cities. These cities are as follows: New Orleans, La., Chicago, Ill., Buffalo, N. Y., St. Louis, Mo., Norfolk, Va., Boston, Mass., Detroit, Mich., New York (Brooklyn), Cleveland, O., Nashville, Tenn., Memphis Tenn., Springfield, Mo., Birmingham, Ala., Dayton, O., Cincinnati, O., Baltimore, Md.

It is a fact that traction engineers as a rule object to concrete under the ties, claiming three distinct disadvantages:

Objections of Traction Officials.—First, that concrete under the ties makes the track construction entirely too rigid, and that rock ballast gives equally as good results and overcomes this rigidity in that it allows a certain amount of resiliency, and that such resiliency is necessary, otherwise undue wear will take place on the rails from passing cars, and that rigid track construction is hard on the equipment.

Second, that in case of reconstruction the railway company is put to an unnecessary expense removing the concrete so as to replace defective or disintegrated ties with new ones.

Statistics show that there is no real ground for the first objection, and even if there were, this can be overcome by keeping the concrete base an inch or so low and bedding the ties in a thin bed of loamy sand on top of the concrete slab. Care should be taken, however, to bring the concrete up on the ends of the ties so as to confine the sand and prevent its shifting.

The second objection can be overruled by the fact that in replacing worn-out or disintegrated ties, the railway company does not have to remove any more concrete than it would otherwise remove were the pavement only on a concrete foundation of the usual thickness, as will be hereafter shown by the method of construction followed by the City of Baltimore. Furthermore, statistics compiled by the Board of Supervising Engineers in the City of Chicago, who have been giving this matter most thorough study for the past eight years, show that sound yellow pine ties, thoroughly embedded in concrete, are almost indestructible.

Another and third objection made by the traction officials is that the car lines have to be diverted, either by means of laying a third and temporary track on the street to be improved, or if the street is so narrow as to prohibit this, there has to be an entire re-routing of the cars, causing by either method serious inconvenience to the public and disorganization of the car company's traffic schedule. This claim can also be overruled by a method which the speaker will outline to you later, as followed by the City of Baltimore.

The experience of all municipal engineers along this line has probably been the same.

Baltimore Work.—Owing to the flat refusal of the traction authorities to install permanent construction, many of us have had to resort to legislative bodies for relief. In the beginning of the year 1914 the situation in the City of Baltimore was thoroughly studied, both by the municipal engineers and the traction officials, with the result that the State Legislature of Maryland was appealed to by the municipality and a law was passed putting the character of foundation under the ties of the several street railway companies and steam railroads under the jurisdiction of the Paving Commission, with power to decide whether such foundation should be of plain ballast or concrete. The commission decided that in heavy traffic downtown streets concrete construction, 6 ins. thick, under and around the ties, was necessary, but that in the outlying suburban section where the traffic was light and street development more or less of an uncertainty, awaiting property development, rock ballast could be used.

The traction officials were informed that they could install the ties immediately on top of the concrete or install a cushion between the top of the concrete and the bottom of the ties. They chose the former.

It may be interesting to note here that in the downtown business section of Baltimore the streets are exceedingly narrow, not over 40 ft. in width between curbs, and there is no room for a temporary third track. Furthermore, the gauge is of odd dimension, namely 5 ft. 4½ ins., so that the track area takes up more space than in most cities. It was also impossible, owing to congestion, to divert the cars to other streets. In order, therefore, to meet this, the third objection of the traction officials, it became necessary to install the concrete without interruption to car traffic. It was at first thought that this could be done by blocking up the tracks an inch or so above the exact grade, installing the concrete, allowing it to set and lowering the tracks to the proper and exact grade. The conclusion was reached, however, that this would not only be very expensive, but hardly feasible, so that it was then determined to pursue the penetration method. This was done by bringing the tracks to the exact grade and ballasting with crushed stone from 1½ to 2½ ins. in size, free of dust and small particles, and tamping the same thoroughly as in ballasting ordinary track, care being taken to thoroughly tamp the ballast and make the same carry the strain of passing cars, then applying a thin cement grout.

In improving streets containing railway tracks the forces of the railway company and that of the paving contractor have to work in conjunction. The railway area is first graded out to the subgrade of the paving by the paving contractor. The railway company then takes charge and grades out to a point 6 ins. below the bottom of the ties. New rails and ties are then installed where necessary, together with any new special work. The ballast, of the size and depth previously noted, is then placed and thoroughly tamped under the ties and up to a point 2 ins. above the bottom of the ties, the rails brought to the proper grade and line, and when the entire construction is "tight" the penetration begins.

The grouting mixture is composed of 1 part cement to 2 parts sand, and is of about the consistency of thin cream. The operation is readily done without interruption to car traffic by the use of a small continuous mixer (known as the Coltrin mixer) placed just outside of and parallel with the railway tracks, with a flexible chute, in two sections, to convey the grout from the mixer to the ballast. Starting on the down-grade end and working up-grade, the thin grout is penetrated into the stone ballast, which, as previously noted, has already been securely tamped and made to carry the strain of the passing cars. As already noted, the chute is flexible and in two sections. When a car comes along the first section is thrown out of service and the second section is lowered to the ballast at about the ends of the ties and the mixer kept in service. After the car passes the first section is thrown back in service.

It is true that during this operation some movement occasionally occurs in the tracks, but there is a city inspector on the work at all times who hunts for and locates loose ties and they are immediately tamped up with green concrete.

The natural supposition is that sufficient movement of the ties and and track would occur to injure the concrete while setting, but this is not true if the work is carefully handled and executed. On one street in Baltimore this work was successfully handled with five different lines of cars passing up and down the street with but 20 seconds headway at times during the day, while on another piece of work it was successfully installed with eleven different lines of cars passing over the special work with less than 20 seconds headway at short intervals during the day. The resultant mixture is about 1 of cement, 2 of sand and 5½ of stone, with the concrete very dense, as the ballast has been thoroughly tamped and voids reduced to a minimum.

This ends the work of the railway company, as after this section of concrete is installed, the paving contractor again takes charge, installing the concrete base for the pavement immediately on top of the railway base, and then the paving.

As a rule, there is no bond between the paving slab installed by the railway company and the paving base installed by the paving contractor, because generally the former is several blocks ahead of the latter, and in the meantime the concrete slab has set. This therefore overrules the second claim of the traction officials, and the penetration method pursued meets the third claim.

One of the principal points gained by this form of construction is that it shows up very clearly every weak place during the progress of the work. All loose or poorly tamped ties are made apparent by the bubbling or oozing up of the grout as a car passes over. Failures in finished pavement are avoided by immediately tamping such ties, which in many cases would otherwise have been overlooked. It has been found by careful cuts made in the finished work that this grout when properly applied penetrates the ballast to the subgrade, forming excellent concrete, and insures solid track construction, free from vibration, upon which the life of any pavement in the railway area depends.

From records kept and compiled by the Paving Commission it has been found that the total extra cost of this construction over plain ballast, including labor and material, is about 52 cts. per lin. ft. of single track.

In the last two years about 10 miles (single track) of such construction has been installed in the City of Baltimore by this process, in the busiest streets of the city, and car traffic interfered with to such a limited extent that you hear no complaint whatever from the traveling public during the course of the work. Included in the 10 miles of single track will be found all classes of paving within the railway area—sheet asphalt, wood block, granite block, vitrified block and scoria block.

Type of Pavement.—It has been suggested that this subject could properly include a discussion as to the type of pavement between and adjacent to the rails which has been found most satisfactory. The most satisfactory type of pavement in the railway tracks on heavy traffic streets is granite block, with a cement filler. Excellent results have been obtained in Baltimore with the recut granite. The old blocks are from 8 to 14 ins. in length. The 8-in. blocks are re-headed, while the 14-in. ones are split, making altogether, blocks smaller and much more uniform in size than the standard new block. The result is a very uniform, even surface, an excellent pavement for track areas.

On streets which may be half business and half residential, or in the retail districts, vitrified blocks should be used.

All block pavements should be laid on a cement-sand cushion.

On strictly residential streets of very light traffic sheet asphalt has been used, but the speaker rather deplores the use of this material within the track areas.

The block pavements are usually laid between the extreme outer rails, including the dummy, with two rows of liners on the outside of each outer rail. Selected granite block, on a mortar bed, is most desirable as liners on heavy traffic streets. On streets of lighter traffic and residential streets, wood block, 4½ ins. deep, thoroughly embedded in the concrete and on a mortar bed, give most excellent results as liners and an excellent finish to the street, particularly where sheet asphalt is laid from the rails to the gutters.

In order to cheapen the cost of track paving our policy the latter part of last year was to install sheet asphalt in the dummy strip, where there is very little traffic, and which will give good results if the track work is stable. We will follow this policy almost exclusively this year, as a modification of our former standard, where asphalt is used between the rails and curb.

Track Details.—The rails are usually of the Trilby type, 105 lbs. to the yard, 7 ins. deep, with a slight bevel on the outer paving edge. With this rail, and the use of steel tie plates and screw spikes, tierods may be eliminated, and by the elimination of the rods better results from a paving point of view are obtained. Tierods are a nuisance in track paving, causing a great amount of cutting if a block pavement is used, and usually have to be placed below the center of the rail in case sheet asphalt is used in order to have them in the concrete instead of in the binder.

Comparison of Mixing and Penetration Methods.—Good construction could unquestionably be obtained by the rerouting of the cars, either by means of a third track and cross-overs or by diverting the cars to other streets, thereby allowing the concrete to be placed by the ordinary mixing method and at the same time allowing time for the concrete slab to set before car traffic is again restored. While this method is a safer way, it is much more expensive than the penetration method. Unquestionably excellent results have been obtained by the latter method such as has been described, its attractiveness being that it is cheaper as to first cost, owing, principally, to the economical manner in which the materials can be handled, and it overcomes the principal objection of traction officials, namely interruption to car traffic, which is of course a serious objection.

In order to obtain good results with the penetration method, every detail must be carefully looked after by the inspectors, such as the quality and size of the stone composing the ballast, the tamping, and the mixing and placing of the grout. Frequent test holes should be cut in order to see that thorough penetration is secured, and wherever possible the penetration should be started at the down-grade end of a block and proceeded with up-grade.

Conclusions.—Under the old system of earth foundation or ballast, failures and troubles were numerous. Under the new system of concrete under the ties, installed as has been described, the percentage of trouble is infinitesimal, the principal defects being at crossings and around special work. It proves conclusively that for strictly up-to-date permanent construction, both for the street railway system and the pavement, the ties should be laid on a concrete base, from 6 to 8 ins. in thickness, and completely enveloped in the same.

A Contractor's Suggestion to Engineers and Inspectors

By JOHN H. GORDON
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Due consideration of the title of this paper and an adequate study guided by the experience of the average contractor leads us to the conclusion that "suggestions from the contractor to the engineer and inspector" must reach him through the highway commissioner and his immediate deputies in order to be effective. For the policy of the commissioner becomes immediately upon his accession the policy of the rank and file, his opinions, his point of view, his very idiosyncrasies are at once reflected in his subordinates. If he be perchance a believer in brick construction for state highways, the department immediately uncovers a host of advocates, exponents, and experts for this form of construction; but should he be succeeded by a commissioner who is in favor of bituminous macadam, the erstwhile brick advocates subside and are replaced or join the ranks of the advocate of the bituminous roads. This reflection of policy is carried out even in detail, and if we find one administration with a hobby for nice looking culverts it will leave behind culverts with a finish that would do justice to a household mantel; but should this commissioner retire and his successor be particular about shoulders and slopes we will find the culvert work resuming its proper importance in construction and now we have a modeled and molded shoulder and a mathematically correct slope. This attitude upon the part of the subordinates is very natural and very normal. There are, of course, some intrepid spirits, generally among the older and more experienced men, who always bear in mind the fundamental and are respectfully but not unduly impressed by the various hobbies that they are confronted with. We are therefore led, as stated in the beginning, to the inevitable conclusion that if the contractors are to make their position plain and their experience of value and effect they must address themselves to the highway commissioners and their deputies.

The form of contract in use in most of the states and municipalities is a relic of the dark ages and contains certain stock sentences and paragraphs that are absolutely unfair to the contractor and are never included in contracts between individuals. These clauses seek to make the contractor liable not only for his own mistakes and misfortunes, and the ordinary hazards of construction, but, in unmistakable terms, fasten upon him the liability for the errors, inefficiency, or carelessness of the state's agents and employees.

We find in many of these contracts the clause: "The Contractor further agrees that he will make no claim against the State by reason of estimates, tests, or representations of any officer or agent of the State." We find further in this same form, that the "contractor assumes all responsibility for damages through the negligence of himself or his agents or employees"—all proper enough, but we find added, "or for any other cause." I might cite further, but from these two quotations it is apparent that there is a one-sidedness to this form which is revolting to every man's sense of justice and fair play. The phrases are old offenders, but it is time they were finally removed. The whole form of contract needs revision; it should be made modern; it should be drawn with due regard to the rights of both parties, and the great states and municipalities should assume for their agents that responsibility which they demand of the contractor for his employees. The inexperienced and timid in office too often take refuge behind these clauses, and the contractor's only recourse is the courts where he has been met before now with the charge of the judge, that having signed a contract carrying these clauses he is liable, however unjust the clauses themselves may be.

The form of contract is important, it is most important because it is basic, but it is with the specifications that the conractor is thrown into daily, almost hourly, contact, and it is to be regretted that most specifications carry this same defect of refusal upon the part of the state to definitely define and assume its own responsibility. Throughout most you will find the clause "and to the satisfaction of the Engineer." There are places where this clause may be necessary, but too often it is due to the neglect to define just what is intended and wanted, and the contractor is at the mercy of the varying ideas, and shifting fancies of the different engineers. Of the same class is the oft-recurring phrase "according to plans, or *as ordered by the Engineer*," sometimes necessary, but usually a shield to protect the engineer from his own or his superiors' hastiness or mistakes and place the burden on the contractor. And under that clause of the contract that I have quoted relieving the state from the responsibility for the "statements" of the engineers the contractor has no legal recourse should the commissioner repudiate the orders of his engineers. Some contracts specifically state that the commissioner shall not be bound by the instructions or orders delivered to the contractor by the engineer.

The inequality in inspection is as marked as it is deplorable and much of it could be eliminated if care were taken to accurately state what is meant and intended.

This care should begin with the preliminary survey which is too often made hurriedly or under adverse weather conditions, and when the actual construction begins the contractor finds that his work is radically different from his idea as derived from the plans and specifications. Final surveys of excavation and embankment at times show as great a discrepancy as 25 per cent., although no great departure has been made from the plans—a result scarcely excusable. The preliminary survey should be made with the utmost care and the plans and specifications drawn therefrom should be the subject of the most careful thought and study, and when finally adopted should not be lightly changed. The location of the material to be used should be definitely and exactly stated and the responsibility for these locations and quality of material should rest with the state. Should these sources of supply be exhausted or deteriorate in quality it should be the state's burden to bear the loss and not, as now in many contracts, the contractor's. No impartial tribunal could rule otherwise.

A word here as to the quality of materials: The rise and progress of the testing bureaus has been rapid. Has too much weight been given to their reports? And is it not true that actual results in construction have been disregarded because of conflict, even slight, with theoretical test reports? Has not this insistence on exact compliance with a fractional standard added greatly to the cost of construction without adequate return? Nature never repeats, there are no two peas in a pod exactly alike, and yet two samples of stone, or of sand, taken on opposite sides of an artificial line, as the boundary of a farm, may in one case be accepted and in the other rejected. It is an able commissioner who can distinguish between theory and practice.

The commissioners of highways would receive much and valuable information by more frequent consultations with intelligent and experienced contractors. No specifications should be drawn without the opinions of contractors being given due consideration, for it is the contractor and not the engineer who builds the road. Look over the records of your departments. You will find that a contractor, Mr. A, has been building good roads for many years, that his roads endure, that the repairs on them are the minimum. You will find that Mr. B, who has been building roads for a like period, has usually poor roads, requiring early and constant repairs, and yet both men were working under the same specifications and under the same engineering force. There is ample evidence to support the claim that the contractor is the one to whom we must look for results and that his judgment and experienced opinion should be given more weight than they have, in most instances, in the past.

The solution of the questions of the disposition and handling of the engineering force, and a proper equal and fair supervision of the work of the contractors is difficult and trying. The complex human equation always confronts us. In the vast volume of work in highway construction it is necessary many times to place young and inexperienced engineers in charge. Their opinion should not be given the weight of the opinion of the experienced engineer as it so often is when in conflict with the contractor. For his own protection the division engineer is apt to place the inexperienced man in charge of the work of the reliable contractor, and the more experienced and diplomatic engineer with the inexperienced and perhaps troublesome contractor, with the result that the good contractor's work is more costly to him, and as a consequence we see today many of the best men being driven from the business.

The position of commissioner of highways in a great state spending vast sums of money is arduous and trying and I know of few positions more difficult to adequately fill. The highway laws are often loosely and hastily drawn and the commissioner is hedged in with so many restrictions that he is at times almost an automaton. There are few points that I have brought out here that are not in accord with the judgment of the experienced commissioner, but until the laws are changed and he is given more discriminating power he is helpless. Politics have been the bane of road building both from the standpoint of the contractor and the engineer, and yet if the leaders of both great parties will review the past and consider the future they must conclude that as a political asset highway patronage is a boomerang.

In my opinion the ideal highway department would have three commissioners, one engineer, one contractor, and one man of affairs, with terms of office of two, four and six years. This would give a continuity to the policy of the department without making it too inelastic. It would secure the position of the engineering force, it would enable the commissioners to become acquainted with their work and their department, with the engineers under them and the contractors doing business with them. It would give time for the tests of materials and forms of construction. It would develop experts. Politics should be removed. Only under a continuous and stable policy can good and permanent work be done.

In a few short years an organization could be perfected that would be of incalculable benefit to the cause of good roads, and would be a source of pride to the citizens of the commonwealth, for the raw material is there. Taken all in all, as a body the men engaged in the engineering profession are as fine, devoted and conscientious a body of men as adorn any profession or walk of life. And may I say for the contractors that most of them value their reputation highly and are anxious to do good work at a reasonable profit, and only ask from the states and municipalities that fair, equal and proper treatment which they would demand and be granted if contracting with an individual?

Brick Streets and Roads

By **H. E. BREED**

First Deputy Commissioner, New York State Commission of Highways

So much has been written about brick pavements, the building, the selection of material, and the methods used in their construction, that most of you are doubtless thoroughly familiar with the subject from a theoretical as well as practical standpoint. I feel safe in saying that with the exception of a few minor refinements, very few changes have been contemplated during the past two years. Appreciating your familiarity with these conditions, I thought it might be most profitable to tell of the work that I know best along this line; that is, the practices and methods of constructing brick pavements in the State of New York; such methods as need extra precaution and care; some of the difficulties encountered in sampling and testing; new departures in the form of construction; the number of miles constructed; the average cost per mile; and, in so far as can be given, some data concerning the relative maintenance cost, not exactly of the pavement proper but of the highway as a whole.

Practices and Methods

It is not my intention to cover all the features of construction. Instead, I should like to emphasize a few of the features often overlooked or only perfunctorily considered, which the work of our department has proven to be of fundamental significance in the success of brick pavements. Other features of equal importance I omit because they have received so much general attention.

In the finished pavement the greatest objection seems to be the longitudinal cracks which appear after the pavement has been down some time. These appear more often on the highways in the country districts than they do in the city streets where there are curbs, sidewalks and cut-off drains on both sides of the road. This would indicate that on the country highways the cracking comes mostly from a wet subgrade in which there is a certain amount of seepage from the ditches and is due in the main to subsequent frost action; while in the cities where the whole roadway has a protective covering there cannot be quite so large an amount of seepage and therefore we find fewer cracks.

To this end, I should like to emphasize the necessity of adequately draining the subgrade. If we are to build a type of pavement as expensive as brick, the small additional expense needed for drainage is amply justified in comparison with the large initial cost.

It is the opinion of the writer that a sand cushion should not be greater in depth than one inch. This means that the foundation must be uniformly smooth, with the sand cushion acting merely as an evener of the surface. It has been claimed that the sand cushion prevents the crushing of the brick and gives an amount of resiliency that is necessary to a pavement of this type. This statement, however, is not borne out in practice, for I have observed a five-year-old pavement in which a mortar cushion was used that has been bettered by the lack of so-called resiliency.

Another point to which it has been necessary to give very careful attention is the washing of brick. Many times brick are stored in piles along the road so long in advance of the construction work that they are so spattered with mud from passing traffic and so covered with dust that it is doubtful whether the grout will properly adhere to them. In all cases of this kind I strongly urge that the brick be thoroughly washed so that the grout will have an opportunity to perform its full function in cementing them together. It is well known that if the grout does not perform this function the individual bricks become loose and the sand cushion shifts on the absorption of moisture so that in a short time it is badly in need of repairs. A large percentage of the bad results which we discover in our maintenance work is due to the fact that the grouting did not perform its full function and cement the brick firmly together.

The smoothness of the finished pavement depends largely on the smoothness of the foundation. A little extra care in this respect will amply repay any contractor. Longitudinal expansion joints should be in place before the brick are laid. Good transverse alignment is essential. It is pleasing to the aesthetic sense; it gives workmanlike look to the job, and the curves are more easily worked out if the courses are straight. Every few courses should be straightened by lightly driving the rows to place with a sledge on a 3 by 4-in. timber, 3 ft. long, laid in front of the brick.

Bats less than 3 ins. should not be used. If necessary, trim the second brick to accomplish this. The bats should be obtained from bricks culled from the pavement, and as every brick is worth from 3 to 4 cts., in the pavement, the selection of bats should be made from culls so that the good half can be saved. This is an element of fairness to the manufacturers which all engineers will appreciate.

Never roll a brick pavement on a wet cushion.

In order to properly grout a brick pavement, the bricks should be thoroughly sprinkled first. Great care should be given to the thorough mixing of the grout (sand, cement and water) first dry, then to a plastic consistency, and gradually thin out until the mixture just reaches the consistency which will flow. In this manner we are assured of getting the best results. Grout should be applied as soon as mixed, and from mixing to application should be constantly agitated to avoid segregation. Two applications of grout are necessary. The first should merely fill the joints and the surplus should be swept in with rattan brooms. Just so soon as the first grout has settled and before the initial set can take place, a second application, of slightly thicker grout, should be spread, which should be squeegeed as soon as it is slightly settled, working the squeegee over the bricks at an angle with the joints and leaving them filled flush. In our work we are allowing the contractor to use one part of cement to two parts of sand where they use some form of grout machine. Where they mix by hand in boxes we require them to furnish grout with one part of cement to one part of sand.

Sand

Many bad results in brick pavements can be directly attributed to the use of poor sands. The inconsistency of present day practice is shown by testing the cement and brick both with a fine degree of engineering precision, and trusting the other material, sand, to visual guesswork.

Three different and distinct kinds of sand are used in brick pavements; concrete sand, cushion sand and grout sand. Concrete sand should be clean and have at least 80 per cent. of the strength of Ottawa sand in compression. Its gradation should be as follows:

Passing the ¼-in.	100 per cent.
Passing the No. 6	85 per cent.
Passing the No. 20	60 per cent.
Passing the No. 50	25 per cent.

and a variattion of not over 5 per cent. from these figures should be allowed. Sand with over 8 per cent. of loam should be rejected. This may seem to be rigid specifications, but if a foundation is to serve its purpose it should be strong enough to sustain the pavement with the minimum amount of cracking.

Cushion sand should be of such a nature that 100 per cent. will pass a No. 6 screen and it should not contain more than 20 per cent. of loam.

Grout sand should be clean and of such a nature that it shall have not more than

100 per cent. passing a No. 6
85 per cent. passing a No. 20
30 per cent. passing a No. 50
5 per cent. passing a No. 100

and it shall be rejected if it contains more than 5 per cent. of loam.

Difficulties Encountered in Sampling and Testing

Many of the shale bloks being used today show great differences in color produced by different grades of burning. Sometimes there are as many as four or five different shades. In sampling, the department has found that this fact, properly considered, is a valuable aid for the determination in the laboratory of what block may be rejected, and for the information of the inspector in the field when the final culling in the pavement takes place; especially so because there is an observable relation between the shades of color produced by burning and the results of the rattler test. We have, therefore, instructed our men to choose samples according to the different colors and textures and to keep duplicate samples of the same shade and texture to be a good guide to the selection and rejection of the poor brick when the results are determined from the laboratory tests, for any person thoroughly familiar with a given brand of brick and the results of the rattler test on the different shades will be able to cull accurately by visual inspection. This does not apply to all classes of block, for many of them are practically of a uniform range of color. But I know of a number of cases in which it has been of very valuable aid in enabling us to get results procurable in no other way.

It has been suggested at various times, both by manufacturers and by some engineers, that it might be advisable to test brick at the plant. The writer has given this subject careful consideration, and it seems to him that the present practice of sampling and testing brick in the field insures better results than testing at the plant, for the following reasons:

Brick are not manufactured uniformly in the same sense that cement or asphalts are manufactured as uniform products.

Long experience with a given brand of brick is necessary before they can be accurately culled by visual inspection.

The men best fitted to cull brick by visual inspection are the employees of the brick company.

The sampling from the different benches of the kiln to show the variations in burning can be done more accurately by the burner than by an inspector.

Variations in temperature in different parts of the kiln give different qualities of brick. These can be assorted and selected best by the men who burn them.

Factory inspection of brick places the responsibility of uniform shipments of acceptable brick on the inspector, and offers an opportunity to the brick company to dispose of cull brick because of their lack of responsibility in the selection.

During the last year this department tested 269 lots of brick, comprising 22 different brands and representing a total of 27,000,000 brick. Of these 13.6 per cent. failed to meet the specifications and were rejected. This does not include the amount culled by the inspectors and rejected on the work; which, in some cases, is rather large. With brick tested at the plant, it seems to the writer that our chances for getting good material would decrease, for if the manufacturers were willing to take such a long chance with a large outlay of freight and handling involved, they would certainly be willing to give inferior material at the plant and would load some brick from the kiln which would not be good enough to go into the work.

New Departure in the Form of Construction

During the past few years two types of new construction have been advocated; one known as the monolithic form, in which the brick are made an integral part of the foundation, and the other the mortar cushion type. Both these have many advantages according to the claims of their advocates. It is the intention of our department this year to try some brick laid with the mortar cushion, and it is our intention in building this type to use some 3-in. and some 3½-in. brick in order to gain economy in the saving of freight charges and handling. It has the advantage of closely approaching the monolithic form of construction and in that way gives added strength to the pavement. Another advantage is that there can be no failures from swelling or shrinking of cushion sand, and should the pavement crack, only the crack will be affected, and not the whole structure as is the case when a sand cushion is used.

Number of Miles Constructed and Average Cost Per Mile

Up to January 1, 1916, New York State had completed 238 miles of brick pavements. These different pavements are of varying age and I will later tell briefly of the cost of maintaining them.

The average cost for brick pavement on 5-in. concrete foundation is per mile of 16 to 26-ft. highway, $25,750. The average cost per square yard of pavement only is $2.015. These figures were obtained from an average of 23 highways.

In order to get a comprehensive cost of other types in New York State, I will give figures on water bound macadam, bituminous macadam, and cement concrete.

Water bound macadam:

Cost per mile of 16-26-ft highway	$10,250
Cost per sq. yd. of pavement only	0.648

The cost per square yard was obtained from 434 values and the cost per mile from 419 values.

Bituminous macadam:

Cost per mile of 16-26-ft. highway	$12,970
Cost per sq. yd. for pavement only	0.871

Both of these items were obtained from the average of 134 highways.

Cement concrete, 6-ins. thick:

Cost per mile of 16-20 ft. highway	$15,320
Cost per sq. yd. of pavement only	1.121

Both of these items were obtained from an average of 20 highways.

It will be noted that the difference between the pavement cost and the total cost of the highway lies, in all cases except brick, between $4,000 and $5,000. The reason why the cost of items other than pavement is apparently high on brick roads lies in the fact that the cost of edging has been excluded from the pavement cost, and included in the total cost.

It may be interesting to note that up to January 1, 1915, there had been built in the State of New York 5,167.19 miles of all kinds of highways; during 1915 this department built 1,083.35 miles, making a total of 6,250.54 miles of road. At the present time there are 783.05 miles under contract, which are not completed.

Relative Maintenance Cost of the Whole Roadway

The maintenance charge for 238 miles of brick for the year 1915 was $41,840, or approximately $176 per mile per year. This amount was increased to a large extent by a number of our older pavements which had many replacements. If we eliminate those we find that we would have 107.91 miles of brick pavement which cost $14,185 to maintain and repair. This is at a cost of approximately $131 per mile. These figures, as we mentioned at first, are not the figures from the pavement alone and they include such treatment as cleaning ditches, cost of patrol where patrol was needed, fixing the shoulders which are cut up by the turning out of traffic, the cleaning of slides and maintaining of guard rail. From observation I think it would be safe to say that about 30 per cent. to 40 per cent. of this cost is the average cost that would cover the maintenance of the pavement alone, although in some cases for a series of years, there is practically no cost to the pavement proper.

With these figures it may be interesting to note the cost of maintenance of other types of pavement during the same year computed on the same basis as that for the brick roads, i. e., including the maintenance of guard rail, shoulders, ditches, patrol, etc., as well as the surfacing.

For gravel we find that it cost $577 per mile for 192 miles of road; for water bound macadam we find that it cost $564 per mile for 2,298 miles of road; for penetration method bituminous macadam we find that it cost $448 per mile for 2,387 miles of road; for bituminous macadam, mixed method, it cost $181 per mile for 63 miles of road. For second class concrete roads requiring surface treatment it cost $532 per mile for 295 miles of road; for cement concrete pavement, 1:1½:3 mix, it cost $129 per mile for 84 miles of road.

The best results are obtained in brick pavements as in all other engineering works by strict adherence to details of workmanship and rigid inspection, for in any engineering work or any work of importance and of a contractural nature, inspection is necessary, for it is human nature to get as much out of any situation as is possible. Where contractors are perfectly honest and put all the materials called for in the work, doing it to the best of their ability, it often fails or gives results not commensurate with its cost. This is probably shown to greater extent in highway construction on account of the many new and different types of construction of which often none of the men on the ground have much knowledge. Rigid inspection should be given all construction work and one man at least on every piece of work should have adequate knowledge of the type of pavement to be constructed. He should be selected by virtue of his knowledge of this type and general constructural work, always keeping in mind the personal equation of the man under consideration, his ability to carry out and complete the work in hand. Where inspectors of this kind are not to be had, they should be trained and only those who are proficient and do good work should be kept in this capacity, for the ultimate result is mainly dependent on them.

In conclusion, it is the opinion of the writer that while many good brick pavements have been built, there is still room for improvement in this branch of engineering work and in reaching out for any betterments that are possible, it is hoped that some of the suggestions in this paper will be of help in future work.

The Development of the Street Opening Problem; Its Effect and Control

By N. S. SPRAGUE, M. Am. Soc. C. E.
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The regulation, control and management of opening street pavements and making excavations therein for the installation of public utility structures required for the supply and distribution of water, gas, power, heat or other utilities and to provide drainage is a complex problem which involves, or has intermingled with it, broad questions relating to the planning of highways, their maintenance and control.

Like many other municipal questions and problems the development of street openings can be traced back to the time when streets were laid out with little or no regard for system or for their future use, in other words, proper city planning. This assertion is not intended to reflect in the least upon those who were responsible for such work as it is beyond the realm of man (even an engineer) to anticipate what the positive future growth and requirements of a community will be fifty or one hundred years hence.

It is believed that by incorporating into all new city planning adequate provision for and proper location of all subsurface structures and with adequate and thorough supervision over the installation of the same much good can be accomplished toward avoiding the opening of paved streets.

In the early stages of municipal development the tearing up of street pavements for making connections was not a serious matter and was regarded as a necessary element of progress, but during the process of evolution the motor-propelled vehicle has supplanted to a very great extent the horse-drawn vehicle and with this transformation in the means of travel has also come a radical change in the character of pavements. The former and comparatively inexpensive types which were considered satisfactory and adequate are now obsolete except under special local conditions. These pavements have been superseded generally by much more durable and expensive types. With the radical change in vehicles using the streets and pavements came the demand for smooth and even surfaces and therefore the cutting and restoration of openings in the pavements also became more of a problem and required more attention.

The expense connected with the control as well as the cost of the physical work has also been increased so that today in most large cities the work is under the direction of the municipal engineering staff. It is not within the scope of this paper to describe in detail the organization, system and manner of control of street openings in the various cities, but suffice it to say that this function in city management is perhaps one of the most complex, annoying and subject to more complaints and criticism than any other part of the public work.

The reasons which may be assigned for opening paved streets are as follows:

(a) For the laying of distribution and supply mains, conduits, sewers, etc.

(b) For making service connections.

(c) For repairs to services or mains.

The situation was not created suddenly and the problem of reducing the number of street openings to a minimum (for it will never be prevented entirely) will require much time and the process will be gradual. The problem therefore which confronts the public official in charge of such matters is how to proceed to accomplish this end.

There appear to be three practicable methods which suggest themselves to the writer as being worthy of consideration.

1st.—That in addition to the usual charge for making the opening an extra charge be made, according to the condition of the pavement and extent of the proposed work, sufficient to compensate the city for the damage done to the entire pavement structure as affecting its future life and appearance and also requiring a guarantee on the restoration of the pavement for such period as will adequately protect the city against repairs.

2nd.—By providing adequate width of sidewalks on all new streets and requiring all subsurface structures to be located therein with duplicate construction on each sidewalk.

3rd.—The building of pipe subways in the business and congested districts of the larger cities in connection with extensive construction or reconstruction.

In addition to the foregoing suggested methods of relief for the abatement of the street opening evil is the policy of endeavoring to absolutely prohibit by legislative action any and all openings in newly laid pavements for a specified term of years. This method has been tried in many cities and the most recent of which the author has knowledge is the City of Cincinnati. After an exhaustive investigation and study of the problem, legislation was enacted by the City Council which is perhaps the most drastic on record.

Section 3 of the regulating ordinance provides:

> That it shall be unlawful for any person, firm, or corporation to make any opening in, break, tear up, excavate, or remove the surface of any street, avenue, alley or other public way, or any portion thereof, in the City of Cincinnati, in, on or upon any street, avenue, alley or other public way, which shall be built, paved, resurfaced or repaved with any material other than water bound macadam at any time within a period of three years, after such building, paving, resurfacing or repaving of such street, or alley; and the Director of Public Service and all other officers and departments of the city are hereby prohibited from granting any permits for any such openings, breaks, tearing up, excavation or removal within said period; provided that the Director of Public Service may, on account of any emergency affecting public health or public welfare, and which could not have been forseen, suspend the operation of this three-year rule as to any application for a permit, and in such cases, upon granting of the application, such work may be performed within the said three-year period; but the mere failure or neglect of the applicant, or other person, firm or corporation, to lay or have laid mains, pipes, wires or connections or other means of transporation of utilities before such three-year period, or the inconvenience, by reason of such failure or neglect, to property along the particular street or way described in the application shall not be considered to be an emergency; provided further that where water mains or water pipes were laid along or to any lot or piece of property previous to the beginning of such three-year period, and, by reason of unforseen development, such water mains or service pipes have become, in the opinion of the Director of Public Service, of inadequate size, then the said Director of Public Service may suspend said three-year rule for the purpose of and to the extent necessary for the laying of larger water mains or larger service pipes in any such street or other public way. The three-year period shall be deemed to begin at the time of the completion and final acceptance by the city of any such constuction, paving, resurfacing or repaving.

The author does not wish to be understood as unqualifiedly approving making openings in street pavements soon after they are laid but to endeavor to show that at least in part the practice when viewed in its broadest aspect is not to be condemned, however much we may dislike to disturb a good pavement, for the reason that such an opening may produce a general benefit to a community which will offset the damage done to the street pavement many times over.

The prevention of street openings in new pavements for a limited period is impossible of enforcement, against good public policy and of doubtful legality. Experience has demonstrated, in a number of cities where such a method has been tried, its utter futility.

In connection with the attempt at prevention of street openings the serving of notices prior to making street improvements, announcing the intention of such action by the municipality, serves a useful purpose and accomplishes much good but the inherent weakness in any policy of control lies in the fact that no municipality can dictate to the owner of abutting property how or when he shall develop, change or alter same. Immediately following extensive changes in grade and street reconstruction in the heart of the business section of this city, there occurred as a direct result of such improvement the erection of many large buildings at a cost of many millions thereby materially increasing the taxable valuation of the city and producing an increased revenue.

The erection of these buildings together with the necessary service connections in the streets has practically ruined many square yards of new pavement covering large areas.

Assuming the existence and enforcement of such regulations as obtain in the City of Cincinnati, the community would be denied a revenue exceeding many times the cost of completely repaving and repairing the streets affected. This loss however would be relatively insignificant when compared with the indirect loss sustained by the city at large and by the individual property owners due to the obstruction to development.

The object sought by such stringent measures is commendable, but their enforcement is obviously opposed in many instances to the more important general public interest.

Mr. S. Whinery, Consulting Engineer, in a letter relating to street openings under date of November 23, 1907, to the Secretary of the Independent Asphalt Association says:

> I doubt if it is practicable to prohibit the cutting into of new pavements for a period of years after their construction. In our rapidly growing and changing American cities, improvements must be made, and the wheels of progress can not be stopped to save a few pavements.

It was generally supposed not later than a generation ago that with the laying of the water pipes, gas pipes and sewers that further cuts in the pavements would be unnecessary but with the advent of new public utilities and the desire to improve the appearance of the streets by placing the wires underground the number of street openings was enormously increased.

As a general rule the laying of all subsurface structures in so far as their use can be anticipated precedes the paving or repaving of a street. This underground construction has been located in the roadway and service connections provided to such buildings as then exist. Later comes the demand for additional service connections, the laying of new utilities and repairs or enlargements to the structures.

The building of a new street stimulates the development of the adjacent property and decisions to erect houses and buildings frequently follow after a street has been improved. Likewise the sale or purchase of vacant property is frequently made as a result of the street improvement. It is recognized by real estate dealers and in fact generally that houses built on unimproved streets produce a much less return than after the street improvement is made. Owners of land are prone to defer the erection of building thereon prior to the paving of the street on account of the uncertainty and possible delay incident to municipal management. The enhancement of values, increase in investment and improved speculative possibilities, together with increased taxation following new street improvements, are potent factors in hastening building operations on newly improved streets.

In the older sections of the cities most of the street openings are made for the installation of new and repairs and enlargements of old utilities and such service connections as are required are the result of changed development of abutting property.

The work of making the cuts and restoration of the pavements was done formerly by the companies owning the utility without much supervision by the municipal authorities and only a nominal charge was made for the privilege. Wherever possible the pavements were restored by the unskilled labor employed upon the work. With the great increase in the number of cuts and the use of modern pavement surfaces more stringent and scientific control was essential to prevent the great loss incident to the rapid destruction of the pavements and to generally improve traffic conditions.

An investigation shows that many of the larger cities have in an endeavor to gain better control adopted the policy of taking over from the companies or individuals the restoration of the pavements over the trenches. This work is done in accordance with carefully prepared legislation providing for the payment of the cost of the work so done and in some cases the charge made for doing work is adequate to cover the cost of inspection, damage and future maintenance.

In the City of Cleveland, permits for making openings are issued upon application accompanied by a deposit of three dollars and an amount according to schedule covering the cost of repairing and repaving, including the inspection by the city of the entire work. The pavements are replaced by the city except those under guarantee which are replaced by the original contractor at prices stipulated for repairs in the original contract. Thus by this method controversies between the city and the contractor due to tearing up pavements which are under guarantee are avoided and the validity of the guarantees are preserved.

The franchise grants to public service corporations in the City of Buffalo provide that all trenches opened in paved streets shall be maintained for a period varying from two to five years and in the case of opening a pavement under guarantee the party making the openings assumes the guarantee on the portion of pavement removed for the remainder of its life.

These requirements are good and amply protect the city but should be extended so as to include all openings.

A change in control of street openings was made in this city about two years ago when a division of public utilities was created in the Bureau of Engineering and all matters relating to the opening of streets were transferred from the Bureau of Highways and Sewers. Following the creation of this division a new ordinance was passed by Council in March, 1915, regulating the opening of streets and prescribing the method of payment.

Under this ordinance the city requires each applicant for a permit to make an opening to file a bond amounting to $500 for a single opening and $2,000 for a number of openings. An initial charge is made according to schedule covering the cost of restoration. The pavements are replaced by the city at the expense of the party making the cut. Formerly all cuts in asphalt pavements were restored by contractors owning plants, which caused much delay and was a source of many complaints.

As will be seen from references quoted the method of control or regulation governing street openings differs greatly in many respects in the various cities. Inasmuch as it seems impossible to entirely prevent the opening of street pavements the only alternative is to secure adequate control which will insure proper work and planning, thereby reducing the evil to a minimum. The regulations should provide for the restoration of the pavements by the city where possible and also for thorough inspection of the work from its inception to its completion.

Special attention should be given to adequate bracing and shoring, especially in yielding soils, to prevent settlement of the adjacent pavement. Tunneling except under special conditions should not be permitted.

The backfilling which is the most important part of the work is generally sadly neglected. The method of consolidation should depend upon the character of the soil but whatever means is used for its consolidation it should be effectual and thorough. The most difficult problem in backfilling is encountered in clay excavations, such as obtain in this city. Whenever it is possible even at the expense of temporary pavements it is desirable to permit complete subsidence.

The author is of the opinion that one of the contributing causes for subsequent settlement of trenches is due to an inadequate use of concrete for the pavement foundation over the trenches. The best practice would dictate removing the old concrete base sufficiently back from the sides of the excavation to secure a good foundation and to break joints. The thickness of the concrete should not be less than 8 ins., with ample time allowed for setting.

The opening of streets in the winter season for the laying of pipes or making connections, from December 1 to April 1, should not be permitted except in case of emergency, as it is impossible to properly re-fill the trenches. A strict adherence to such a rule will do much toward preventing dangerous settlement of the trenches and consequent repaving.

In the laying out of new streets the municipal authorities should rigidly insist upon proper planning, including ample sidewalk widths. In the past it would appear that property owners have been reluctant in dedicating sufficient property, or the cities unwilling to condemn sufficient to provide ample street width, and subsequent developments have clearly indicated the error of such a short-sighted policy since wide streets would have enhanced the value of the property and made it possible to provide space for the substructures. In the newer residence districts, however, more liberal width of streets prevail and the sidewalks have been used for the location of many of the underground structures. The openings in the sidewalks for connections or laying mains is not a serious matter as the sidewalk pavement supports only pedestrian traffic. It may also be found possible where conditions permit to widen the sidewalks in connection with repaving or reconstruction and thus provide adequate space for the installation of additional substructures. In general it would seem advisable where possible to locate all water pipes, gas pipes, sewers, telephone and other conduits in the sidewalk and require duplication of these lines on the opposite side of the street. In the case of large supply mains or sewers such works could be laid in the roadways as service connections are not generally permitted.

Questions of expense will arise in the discussion of these matters but when the additional first cost for duplicate lines is weighed against the cost of maintenance and the saving in the advantage of short connections, the author believes that the ultimate benefit to be derived by the duplication of lines warrants and justifies any additional expense. It should also be borne in mind that there is a very great indirect loss to business and the public by the constant tearing up of streets and this taken together with the danger of accidents constitutes an element which must be considered.

The cities of New York, Philadelphia and possibly others maintain an engineering force to keep a record of the location and depth of all subsurface construction in the city streets. These records are kept up to date and assignments of location for new structures to be placed underground are readily obtained. This system also avoids unnecessary excavations in the streets.

In closely built-up and congested business districts of cities, the solution will be hard to find. The available space in most business streets has already been given over to the various public utility companies and is occupied in many cases to capacity by substructures. There has been in many cases a needless, and, to say the least, a most undesirable duplication of lines. The result is a hopelessly confused mass of pipes, sewers and conduits for the distribution of light, heat, power and other purposes. Congestion is materially increased by the fact that frequently the trunk or main lines traverse or radiate from the business districts. This is essentially the case with telegraph, telephone, signal and pneumatic tube service. Moreover, grants are frequently made to property owners permitting the construction of tunnels or subways crossing the streets, affording communication between buildings or serving as pipe galleries for the supply of heat, light and power. The addition of numerous service connections adds to and enormously complicates the situation. As the streets are narrow and the sidewalks given over to the use of vaults, there is little opportunity of rearranging these substructures with the ultimate end in view of avoiding street openings for repairs or making connections.

The construction of pipe galleries or subways in the congested districts would appear to afford the only solution of the difficulty. They could be built either by the municipality, in which case rentals would be paid by the companies using the tunnels, or they could be built by the companies themselves as a joint project. Such systems are in use in the cities of London, Paris and Berlin but they were built in conjunction with the extensive reconstruction of the streets wherein they are located and therefore the most favorable conditions prevailed for the inauguration of the tunnel system. Under less favorable circumstances it is doubtful if these tunnels would ever have been built.

The American cities have not adopted the tunnel or subway system except in a very limited way and by force of necessity due to the building of transportation subways which required practically all the space in the streets. There are at least two very important questions which must be considered in connection with the relocation of subsurface structures and placing them in pipe tunnels. The first question relates to the expense of the project and the second to the necessity of an agreement between the utility companies themselves and jointly with the municipality. It is beyond the limits of reason to expect and it would impose too great financial burden upon the companies to require the general abandonment of the present underground construction and the building of pipe galleries with all utilities located therein. It is possible however, provided the companies agree and where extensive rearrangement of the subsurface construction is made necessary by other improvements, to place the structures together in a pipe tunnel. Under these favorable conditions for the adoption of pipe subways many years will ensue even in the most congested parts of the cities before the practice can become general.

While it is admitted that pipe subways are expensive, yet if you would take the cost of the total number of street openings made in a single year in the average American city, this sum would represent the interest upon a very considerable capital investment for pipe subways. The total expense connected with making these openings is distributed among so many companies that no individual company is impressed with the economy of pipe tunnels. Cooperation is therefore one of the essential elements in connection with the general use of pipe subways. With the development of the public utilities and the creation of new ones, will no doubt come the need for placing these structures in pipe subways but it seems to the author that the time has not yet arrived except to a limited degree for the adoption of this system.

Reviewing the whole subject of street openings rather briefly, it is apparent that the subject has been given careful and intelligent study but the solution of the problem, in so far as prevention is concerned, remains to be found. In the last analysis the whole question at present resolves itself into one of efficient and effectual regulation and control.

The Functions Performed by Stone in the Bituminous Concrete Pavement

By R. B. GAGE
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If the maximum amount of service is to be secured from any bituminous concrete pavement, it must not only be constructed by experienced men using first-class equipment, but the various ingredients composing it should be so proportioned and blended that on the one hand the benefits to be secured by the use of each will be the maximum, while on the other the injury that they may cause will be reduced to a minimum.

An examination of some of the specifications now in use describing this particular class, shows quite plainly that some of the pavements defined therein will not give as efficient service as could be secured by using the same ingredients in different proportions. These variations in grading are not the result of careful preliminary determination of the conditions to which the pavement will be subjected, with a subsequent selection of the particular grade best suited to combat these conditions. The usual object is to secure a pavement that can be constructed at a very low initial cost and yet possess all the merits of a first-class bituminous concrete pavement.

If the real value of such pavements is to be determined by the service rendered, it will be necessary to wait until their merit has been thus demonstrated before passing judgment. It is seldom that they begin to show any serious signs of failure before they are three or more years old, unless they have been laid on very inadequate foundations or were of exceedingly bad construction. During this interval a large quantity of this same grade of pavement may be laid if the firm or contractor representing the same is very aggressive. When failures begin to appear in the original pavement laid, the contractor may have gone out of business or have disappeared. Another grade is then substituted for that previously laid which may at the end of three to five years, prove to be equally as unsatisfactory as the former.

If errors of this kind are to be prevented, it is necessary to determine before selecting the grading just what functions are performed by the ingredients to be used. Once these have been determined it becomes possible to so proportion the ingredients that the maximum amount of benefit will be secured by their use. That this type of pavement possesses merit, when the ingredients are properly blended, has been repeatedly demonstrated and quite conclusively proven even when subjected to very adverse conditions. The numerous premature failures have also shown that if the ingredients used are not properly blended the life of these pavements will be shortened accordingly.

In the surface of a sheet asphalt pavement but three ingredients are needed, i. e., sand, filler and asphalt cement. The diamenter of the largest size sand grains seldom exceeds 0.1 in. These grains have a hardness of 7 and will absorb little if any water. With a given sand the percentage of asphalt cement used is confined to fairly narrow limits. The same is also true of the filler. The life of such a surface is greatly lengthened, and its ability to resist creeping and decomposition, caused by water attack from beneath, is much reduced by laying the same on a binder course. The thickness of these surfaces varies from 1 in. to 2 ins., being generally about 1½ ins. It is not uncommon to find pavements of this type in fairly good condition after 20 years of service. Even when subjected to quite severe traffic they will last from 10 to 15 years with very little repairs, yet the original surface was not over 2 ins. thick and contained no ingredients over 0.1 in. in diameter. It is thus seen that the life or wearing properties of a bituminous pavement is not dependent upon the use of stone in the wearing surface.

If this pavement could be judged by its durability and resistance to abrasion, it would be ideal, but unfortunately it possesses certain inherent defects. It is slippery when wet and quite brittle during cold weather. On account of this brittleness a very rigid foundation is required. The grading of the aggregate calls for the use of a greater quantity and of a harder asphalt cement than is used in a bituminous concrete pavement. A greater quantity of filler is also needed. These are the most expensive ingredients used in bituminous pavements. The use of a binder course also increases the cost of construction and makes the repairing of holes more difficult than with a single course pavement.

When a certain per cent. of the aggregate of a bituminous pavement consists of broken stone larger in size than 0.1 in. in diameter, it possesses more inherent stability and density than a pavement, the aggregate of which is all smaller than 0.1 in. in diameter. The amount of inherent stability thus imparted to a pavement will vary with the size and quantity of the stone used and its thickness. On account of the added stability thus given the pavement a much softer asphalt cement can be used than in a sheet asphalt pavement and a binder course is not necessary to prevent creeping. The percentage of voids and surface area of the aggregate can also be so reduced that about 4 per cent. less asphalt cement will be required. By using a fairly soft asphalt cement such a pavement is given sufficient elasticity and pliability during cold weather to safely allow the use of a base having a limited amount of movement. The stones contained in these pavements also prevent their surfaces from becoming as smooth and slippery as a sheet asphalt surface.

It is thus seen that the principal functions of the stone are:

First, to give the pavement increased stability.

Second, to allow the use of a softer asphalt cement.

Third, to reduce the percentage of voids and surface area of the aggregate.

Fourth, to elminiate part of the slipperiness in the surface during wet and cold weather.

The first allows us to dispense with the binder course; the second admits of the use of a base that is not altogether rigid; the third reduces the quantity of asphalt below that required with a pure sand mix. All of these reduce cost.

The influence of all of these factors will naturally change with the stone content. If the maximum stability and minimum void content are to be secured it is necessary that the stone content should be fixed between fairly definite limits. The larger sized components of the aggregate should be present in sufficient quantity to form the skeleton or framework of the pavement. The quantity required for this purpose will vary with the size, shape and grading of stone used. The greatest density is secured when the smaller sizes of the aggregate are present in sufficient quantity to just fill the voids in the larger sizes. This is best accomplished by using a fair proportion of stone whose largest dimension is about one-half the thickness of the pavement. The percentage of voids in the stone will generally be between 30 and 45 per cent., consequently the stone content of the aggregate should be from 55 to 70 per cent.

If the fine aggregate is not present in sufficient quantity to fill the voids, the pavement is not as dense as would otherwise be the case and may not be waterproof. As the quantity of the fine aggregate is increased over that needed to fill the voids in the stone, the inherent stability is decreased and the void content in the total aggregate is correspondingly increased. If there is a considerable excess of the fine aggregate the stone simply floats in the mortar aggregate and the principal reason for its use is thus destroyed. If the use of stone did not introduce conditions injurious to the pavement, little harm would be done by its use excepting to increase the cost of the pavement. However, since a danger is thus introduced which may shorten the life of the pavement considerably, it becomes very important that the quantity of stone used should be such that the maximum benefits will be secured by its use.

The sand grains in a sheet asphalt pavement, as above stated, are practically impervious to water, have a hardness of 7 and are practically free from any definite planes of cleavage. The stone used in a bituminous concrete pavement will not meet the requirements of such a standard. Trap rock has a hardness of about 6, shows planes of cleavage and is not impervious to water. Granite, limestone and dolomite are softer yet, have more pronounced lines of cleavage and are much less impervious to water.

When in use, the thin bituminous coating is worn off the faces of the stone. The porosity of the stone is increased by being more or less shattered by the shocks of travel. When unprotected faces are thus exposed, the stones become saturated whenever the pavement surface gets wet Moisture is thus carried into the body of the pavement and attacks the bitumen. The rapidity of decomposition of the bitumen depends first upon the porosity of the stone and second upon the ability of the bitumen to resist hydration and oxidation. The bond between the bitumen and the stone is first destroyed and then the layers of adjacent bitumen are decomposed. When the bond between the stone and asphalt cement has been thus ruined the stones will drop out of a section of pavement when it is broken open like nuts from their shells. No trace of asphalt cement can be seen on them and their surfaces are usually bright and clean.

Certain types or grades of stone are often selected for an asphalt pavement on account of their open texture or porosity which allows the asphalt cement to penetrate into the surface of the stone to a slight extent. In this manner a better bond is supposed to be secured between the asphalt and the stone. This appears to be a step in the wrong direction, for the more porous a stone the more moisture it will absorb. A good asphalt cement will adhere to sand grains even when they are fairly smooth. No broken stone possesses any such polished surfaces. The denser, harder and tougher a stone is, the better it is adapted to fulfill the functions required of it in a bituminous concrete pavement. No trouble has ever been experienced in securing a good bond between an asphalt cement and the hardest and closest grained trap rock found in New Jersey.

In the original Topeka-Sterling specifications, if the aggregate retained on the 10-mesh sieve is designated as stone, we find that not less than 8 nor more than 32 per cent. of stone can be used. In the modified Topeka specifications recently adopted by the American Society of Municipal Improvements, the stone content may vary between 20 and 30 per cent. Each of these specifications gives a bituminous mixture in which the stones simply float in the sand aggregate. Both of these gradings give a pavement which possesses all the defects inherent in a bituminous concrete pavement and some of those peculiar to sheet asphalt, with few if any of their respective virtues. They have not the stability or density of a properly graded bituminous concrete, require a greater quantity of asphaltic cement, are more brittle and slippery, and lack the uniformity and endurance of sheet asphalt. It is claimed for these pavements that they do not infringe on certain patent rights. This certainly is not sufficient to justify their use. If their value is to be determined by the service rendered, much time and expense will be saved by selecting types of construction whose value has been definitely proven, even if the initial cost be somewhat higher. The saving in initial cost which may be made by using an improperly graded pavement is soon lost if the pavement fails prematurely. In such cases those responsible for its selection or construction are usually severely criticized and not without reason.

The Columbia Highway

By H. L. BOWLBY

Former State Highway Engineer of Oregon

The nation-wide campaign for better roads has been responsible for the construction, during the past five years, of many highways that have not only a local interest but also a national importance. The continuance of the European war has added an unusual impetus to the building of trunk highways that will enable Americans to "see America first" and at the same time link together neighboring states with a means of communication that will form an important part in any plan of national preparedness.

For the growth of these national highways the Pacific Coast has proven to be the most fertile ground. An immense territory, with few existing roads, it is a paradise for the highway engineer, afforing as it does an opportunity to display his ingenuity and to put into practice the best there is in modern highway engineering.

Our Pacific Coast states are separated from the main part of the United States by an almost impassable barrier. The Cascade Mountain range is unbroken from British Columbia to Mexico, except in three places: the Frazier River on the north of Canada; the Klamath River between Oregon and California; and the Columbia River between Oregon and Washington.

There are several passes which make it possible for the transcontinental railroads to reach the coast during most of the year. Every winter some or all of these railway lines are blocked by snow. The only route to the Pacific Ocean that was open every day this past winter was the Columbia River route.

It is very appropriate that the Columbia Highway should be described at a meeting of the American Road Builders' Association, as its inception on the grand scale that has marked its construction was due to the foresight and initiative of one of the past presidents of this association, Mr Samuel Hill.

Mr. Hill is affectionately called in the Northwest the "Father of Good Roads." For more than ten years he has continuously preached the gospel of better roads to the people of Oregon and Washington.

The great gorge of the Columbia River provides some of the grandest scenery in the world. Its beauties have been portrayed by John Muir, John Burroughs, Joaquin Miller, and many other lovers of the beautiful in nature. The Columbia River Canyon is so rugged that no attempt to build a road through it was successful until the project started in 1913.

The need of a highway to connect the Oregon seacoast with the broad, fertile acres east of the Cascade Mountains has long been recognized. The first wagon road built was on the Oregon side of the river in 1856. It connected Bonneville and the Cascades where are now located the Cascade Locks, a distance of six miles. The next step towards a Columbia River road was taken in 1872, when the Oregon Legislature appropriated $50,000 for the construction of a road from the mouth of the Sandy River to the city of The Dalles. The road built with this appropriation and one of an equal amount made four years later was very narrow and had very steep grades and poor alignment. In 1882, when the O.-W. R. & N. Railway was built, this road was appropriated in many places and never reconstructed.

In 1910 Mr. E. Henry Wemme, an early automobile enthusiast of Portland, Oregon, circulated a petition to have constructed a road from Bridal Veil Falls east to the Hood River County line. A survey followed which included the section from Latourell Falls to Chanticleer. This survey provided for a narrow road with sharp curves and grades as steep as 9 per cent. In 1912, 1.8 miles were built east from Bridal Veil Falls. This section was relocated and rebuilt in 1914 to bring it to the standard established by the State Highway Commission for state trunk roads. These standards provide for a roadbed 24 ft. wide both in cuts and fills, and a maximum gradient of 5 per cent. The minimum radius of curvature is 200 ft., except in a few exceptional cases. In no place has a radius of less than 100 ft. been used and wherever the radius of curvature is less than 200 ft. the grade on the curve has been reduced at the rate of 1 per cent. for each 50 ft. of reduction in the radius.

In the spring of 1912 Samuel Hill made a trip on foot over that section between Warrendale and Eagle Creek. Two friends were his guests on this reconoissance and he talked them full of the advantage to be derived from a modern scenic highway from Portland east along the south bank of the Columbia River, no grades to be over 5 per cent. and the road to be 24 ft. wide everywhere. It all sounded good, but his friends thought he was dreaming.

In the fall of 1912 another step was taken toward the construction of this river road. Gov. Oswald West had been experimenting with convict honor camps in building roads in southern Oregon. Mr. S. Benson, a wealthy timberman of Portland, donated $10,000 to be used at one of these camps in the construction of a road around the foot of Shell Rock Mountain. This mountain, which is in Hood River County, had been regarded as an impassable barrier to a wagon road. The work done, however, by the convicts on this section called attention anew to the Columbia River Road.

In 1913 the building of the Columbia Highway on its present magnificent scale was undertaken. The State Highway Department, which was created this same year, had charge of its location and the engineering of all kinds required in the undertaking. Oregon was the last of the Pacific Coast states to establish a highway department. Samuel Hill's influence was felt again in this matter. In February the members of the Oregon Legislature were his guests on a trip by special train to Maryhill, his country estate on the Columbia River. He had built, at his own expense, several miles of modern hard surfaced road near his ranch, costing $120,000. After listening to an illustrated lecture on road building by Mr. Hill and inspecting thoroughly these roads, the Legislature enacted the law providing for a state highway engineer and a system of state roads.

The State Highway Commission, thus created, secured the services of the writer as State Highway Engineer, and launched an extensive road building campaign.

No money was available for the use of the department except $10,000 set aside for office expenses. A campaign of education was started with the object of inducing the counties to vote bonds to build trunk roads under the direction of the state commission. The first to take advantage of the new law was Jackson County. On July 3, 1913, this county turned over to the State Highway Department the location and construction of the Pacific Highway in that county, and raised $500,000 from a bond issue for this purpose.

Counties on the Columbia River were the next to feel the effect of the state-wide campaign for good roads. Clatsop, Columbia, Hood River and Multnomah Counties raised altogether $2,335,000 for the construction of the Columbia Highway. On July 26, 1913, the Board of County Commissioners of Multnomah County, under the leadership of its chairman, Rufus C. Holman, appointed an advisory committee to advise them on matters connected with the new departure in modern road building. On September 24 the County Board turned over to the State Highway Department all engineering connected with the Columbia Highway in that county and set aside $75,000 to the order of the state commission for this purpose. An assistant highway engineer was placed in charge of the different units. S. C. Lancaster was assistant highway engineer in charge of the work in Multnomah County. Surveys were made and construction started in October, 1913. Twenty-two and one-half miles of new road have been completed to date at an approximate cost of $1,300,000. This amount includes the cost of surveys, grading, building the large reinforced concrete bridges and paving the road with Warrenite pavement for a width of 18 ft.

A feature of the construction in Multnomah County was a "millionaire" roadmaster.

John B. Yeon, one of its leading citizens, has given more than two years of his time free to the public and has had active charge of the construction of the county roads. All of the road construction, except the bridges and hard surfacing, was done under his direct supervision by foremen and gangs of laborers. The bridges and viaducts were built and the pavement laid by contract. The cost of the Warrenite pavement, including a ten-year maintenance bond was approximately $15,000 per mile.

The bridges and viaducts in Multnomah County are worthy of special mention. Reinforced concrete construction was used in all cases. Many of the structures are of novel design, an effort having been made in each case to fit the structture into its natural setting and to make the completed bridge a work of art as well as an example of the best economical engineering practice.

The Latourell Falls bridge is a concrete arch structure 312 ft. long and 97 ft. high to the grade of the roadway. It carries a 17-ft. driveway with a cantilevered sidewalk and railing on each side, which bring the total width of the structure to 25 ft. The most noteworthy feature of this bridge is its lightness, the total amount of concrete above the ground being only 560 cu. yds. One of the factors making necessary a light structure at this place was the difficulty of securing a firm foundation. The underlying bedrock is covered with a layer of silt and bowlders, having an average depth of 25 ft. at the western end of the bridge and with deposit of drift sand, 50 ft. deep, at the eastern end. The cost of building abutments and piers for a heavy bridge would have been very high under these circumstances. Notwithstanding the lightness of the structure the factor of safety is as high as that of any bridge on the highway and is above standard requirements.

The west abutment and the two intermediate piers rest directly on bedrock. The east abutment rests on four columns, two 4 by 4 ft., and two 5 by 5 ft. in section. The average depth of the columns from the under side of the abutment to bedrock is 45 ft. The tops of the 5-ft. columns are connected with the bases of the 4-ft. columns by inclined struts.

The central portion of the bridge consists of three 80-ft. parabolic arch spans. Each span consists of two arch ribs, 20 ins. square, reinforced by eight 1-in. square bars, placed longitudinally, and No. 0000 hooping, 18 ins. in diameter with a 2-in. pitch. The roadway is carried by vertical columns, extending to the arch rib and placed 10 ft. apart, center to center, and connected by diagonal members. There is also a cross tie connecting the arch ribs at each panel point. The diagonal members being subjected to alternating compressive and tensile stresses, special care was necessary in the placing of the reinforcement.

The specifications under which the bridge was erected allowed the following stresses: Concrete in bending, 600 lbs. per sq. in. compression; concrete in direct compression, 500 lbs. per sq. in., hooped concrete in the arch ribs, 750 lbs. per sq. in.; steel in tension 16,000 lbs. per sq. in.; steel in shear, 10,000 lbs. per sq. in. The specifications called for loading as follows: A uniform load of 100 lbs. per sq. ft.; concentrated load of 15 tons, and impact factor of 25 per cent. Analyses were made for three conditions of loading, as follows: A uniform load over the entire bridge; half the span of one arch loaded; and two spans fully loaded with no load on the third span.

The main columns, which are about 90 ft. high, were poured in sections which were allowed to set for a few hours before further pouring. The ribs were poured simultaneously, the pouring proceeding from the springing lines toward the crown. The deck was poured in one operation, after the arches had been allowed 12 days to set. The maximum settlement during the pouring of the arches was ⅜ in., and there was no settlement while the deck was being poured, or afterwards. The centers were struck six weeks after the arches were poured. The total cost of the completed structure was $26,936.12.

The Shepperds Dell bridge is a single span, reinforced concrete bridge, 150 ft. long and 130 ft. above the creek bottom. The arch has a span of 100 ft. and consists of two parabolic arch ribs 3 ft. 2 ins. square at the springing lines and 3 ft. 2 ins. wide by 2 ft. 2 ins. deep at the crown. The deck is carried by four columns on each end of each arch rib, spaced 10 ft. center to center, and by a solid spandrel extending 20 ft. each way from the center. The bridge carries a 17-ft. driveway and two 3-ft. cantilevered sidewalks. Its total width, including the railings, is 25 ft. The total cost complete was $10,763.07.

The bridge below Multnomah Falls is a five-centered concrete arch, with solid spandrels, the space over the arch barrel being filled with earth. The bridge is 67 ft. long and the span of the arch 40 ft. The total cost was $4,127.35.

At two places the location of the highway at the base of the mountains and inside of a railroad track made it necessary to build viaducts or excavate an enormous amount of material. On account of the cost of such grading and the lack of a place to waste the excavated material, it was decided to build the viaducts. These are two in number and have a total length of 1,260 ft.; width of roadway 18 feet. In each case the roadway is carried on columns spaced 20 ft. apart, longitudinally, and 17 ft. 6 ins. apart, transversely. Both rows of columns are parallel to the center line of the highway, the columns on the side toward the hill being, of course, considerably shorter than those on the outside. The footings of the two columns in each bent are connected by an inclined strut, which is capable of carrying the weight of the structure and is provided to insure against settlement of the upper footing. The approaches are held by retaining walls of dry rubble masonry. These viaducts cost complete $26.22 per lin. ft.

At Oneonta Gorge a concrete girder bridge was built 80 ft. in length at a cost of $2,498.36.

Below Horsetail Falls a concrete bridge similar to the above was built across Horsetail Creek. Its length is 60 ft. and it cost $1,819.70.

A small concrete foot-bridge was constructed over Lower Multnomah Falls. Its length is 50 ft., and it cost $1,200.

Across McCord Creek, a concrete viaduct carries the highway for 360 ft., eighty ft. above the bottom of a ravine. The viaduct is supported by four-post towers, having girder spans of 54 ft. between towers. Two girders with crossbeams carry the two-way slab floor construction.

A load of a 20-ton roller or 100 lbs. per sq. ft. of road surface was used in the design. Impact was added using the formula: $\text{Impact} = \frac{L^2}{2\,(L + D)}$, where L and D represent the live and dead load.

The railing on this bridge was poured in place and later rubbed down with carborundum stone and sand floated. Top railing and curb were both reinforced sufficiently to prevent temperature cracks, and none have developed. The cost complete was $17,653.

The Tanner Creek Bridge is a concrete deck girder span of 60 ft. with wing abutments 20 ft. high. Floor beams between girders permitted of two-way slab deck construction.

For a distance of 180 ft. on the highway above Bonneville it was found to be cheaper to carry the road partly on a concrete viaduct and partly on the solid rock roadbed, rather than to cut the full roadbed out of the vertical rock cliff—which rises 700 ft.

Columns carried down to the face of the rocky cliffs support girders of from 20 to 30 ft. span. The floor beams are carried at one end by the girders and at the other end are embedded in notches cut in the cliff. This construction saved the immense amount of solid rock excavation, which would have been necessary in excavating a roadway 24 ft. in width. About 12 ft. of the roadway is carried on the concrete structure, and the balance on the cliff shelf.

The same typical stone railing that follows the highway along the edge of the cliff is used on the viaduct.

The Eagle Creek arch is a three-rib, half-circle arch of 60 ft. span, the deck being carried on spandrel columns and the entire concrete construction covered with a rock veneer. This stone arch ring carries the stone spandrel wall. The rock arch and spandrel wall are tied to the concrete ribs by small steel hooks passed through loops embedded in the rib. The abutments are made of dry rubble masonry. The cost complete was $8,500.

The Moffett Creek arch is probably the most unique of the concrete bridges on this highway. It has a clear span of 170 ft., with a rise of only 17 ft. It is a true three-hinged reinforced concrete arch bridge. The hinges are of massive cast iron with 4½-in. steel pins to carry the load. The two arch ribs were designed for a live load of 200,000 lbs., distributed uniformly over half the span. The beams and floor span were designed for a 20-ton roller. This is the longest three-hinged concrete bridge in the world. The cost complete was $16,390.39.

The Columbia Highway in Oregon begins at Seaside, on the Pacific Ocean, in Clatsop County. It parallels the ocean beach for 12 miles and then cuts directly across the marshlands, a distance of 12 miles, to the City of Astoria. From Astoria to the Columbia County line the highway extends 28 miles in this county. This section was graded in 1914. The county voted a bond issue of $400,000 on November 4, 1913. The surveys were started by the State Highway Department October 16, 1913, and completed April 4, 1914, covering a location of 46 miles, much of it through some of the heaviest standing timber of the Northwest. The contract for constructing the first section of 28 miles in this county was let May 11, 1914. Its cost, including grading and bridges, is $300,000. It will be hard surfaced by the state in the near future. It was in Clatsop County that the first section of the Columbia Highway was paved, 2 miles of Warrenite being laid in 1914 between Seaside and Gearhart. A contract has now been let to continue this class of pavement 6½ miles to Warrenton. There were laid 3 miles of concrete pavement in 1914 between Warrenton and Astoria.

On Bugbee Mountain, 23 miles east of Astoria, and overlooking the mouth of the Columbia, the highway runs out of a forest of firs at an elevation of 700 ft., to descend 650 ft. on a 5 per cent. grade along the face of the cliff.

The descent is accomplished by four wonderful hairpin curves, and yet the road is so located that a long sight line for the autoist is preserved on each curve. This is unquestionably the grandest feature of the lower section of the highway. From the crest an unbroken view is obtained up and down the river for a distance of nearly forty miles.

Following the river towards Portland the highway passes through Columbia County for 56 miles. The scenery in this county is not so grand, but the cost of grading was very heavy. The most scenic section will be the Beaver Valley unit, on which are located the beautiful Beaver Falls. In February, 1914, Columbia County voted a $360,000 bond issue, which was turned over to the State Highway Commission for expenditure. The surveys, started October 17, 1913, were completed April 21, 1914, and construction began on May 17 of the same year. An indication of the character of the country through which the highway runs is shown by the cost of making the surveys in this county, the average cost per mile of located line being $239.15. Some of the heaviest standing timber of the Northwest was encountered on this section.

Multnomah County raised $1,250,000 by a bond issue to build its share of a highway bridge across the Columbia River at Portland. It also raised $1,250,000 from another bond issue to hard surface the Columbia Highway and other trunk roads in the county. The money for grading the road and building the bridges was raised by direct taxation. In Multnomah County the highway has been practically completed and paved for a distance of 44½ miles east from Portland. At a distance of 23 miles from the city, Crown Point is reached. The road here is carried around the top of a rock cliff at an elevation of 750 ft. above the river, on a curve of 110-ft. radius. The central angle of the curve is 225 degrees. On the outer edge of the road there is a 7-ft. sidewalk, protected by a concrete railing 4 ft. high.

Latourell Falls is passed at 26 miles and Shepperds Dell at 27.5 miles. Bridal Veil Falls is 1 mile farther and Gordon Falls or Waukena (most beautiful) Falls in Benson Park are 31.5 miles from Portland. Multnomah Falls, the largest and grandest of the ten waterfalls encountered in this county, are a mile beyond Waukena Falls. A large park of 400 acres including the best of the falls and the most rugged of the landscape was purchased and presented to the public as a gift by S. Benson, of Portland.

Another point of especial interest is the Oneonta Gorge and Tunnel two miles from Multnomah Falls. The highway crosses the stream on a reinforced concrete bridge and passes immediately into a tunnel 125 ft. in length. The height of the rock cliff is 205 ft., the railroad is close to the face of the cliff and the river is next to the railroad so that a tunnel was the only solution of the problem.

Horsetail Falls are a few hundred yards farther and 40 miles out from Portland the scenic, three-hihged arch bridge over Moffet Creek is crossed.

Twenty miles more and the Bowlby Tunnel is entered and the city of Hood River is 5 miles farther east. Pendleton, the home of the "round-up," is the eastern terminus of the Columbia Highway, distant from the beginning 363 miles. A variation of rainfall of unusual degree is found on this highway. At Astoria, nearly 100 ins. per year is the average; at Portland 42 ins.; while at Cascade Locks the precipitation is 77 ins.; and 60 miles farther east it is 15 ins. per year.

In Hood River County the gorge of the Columbia widens out again above the Cascades, producing some of the grandest and most rugged scenery to be encountered in the world. At one point, 5 miles west of Hood River City, it was found that the most economical construction would be a tunnel through solid rock for a distance of 400 ft. To have built over the point of rock using the maximum grade of 5 per cent., would have required an additional mile of road. The state appropriated $50,000 to construct this section of the highway 4,500 ft. in length. Topographical conditions were right for a tunnel with windows cut out to the face of the rock cliff. A 200-ft. viaduct of reinforced concrete was planned for the west approach. The tunnel portal at this end is short, the highway entering the face of a rocky nose. At the east end the portal excavation is more than one hundred feet long. There are five windows in the tunnel, each window being approximately 20 ft. long and 19 ft. high. The tunnel section is 18 ft. wide and 19 ft. high. The tunnel required very careful work on the part of the contractor, the specifications providing a bonus for carefulness in excavating the tunnel and window sections. The tunnel cost complete $14,472.85, and its actual length is 390 feet, giving a cost per lin. ft. of $37.10. The concrete viaduct approach at the west end cost complete $8,550.30, its total length being 208 ft. and its cost per lin. ft. $41.10. This high unit cost was due to the great length of the supporting columns required.

This tunnel is much grander than the Axenstrasse on Lake Lucerne in Switzerland. The windows are protected by concrete railings and are recessed to provide ample room for tourists to stand and view the Columbia River 150 ft. below and the rugged shores of Washington on the far shore.

Hood River County voted a $75,000 bond issue which was used in grading 6½ miles of the highway in places where no road existed. The completion of these sections made it possible to open the Columbia Highway to traffic in August, 1915.

At the western terminus of the Lincoln Highway the Columbia section will give a feeling of pleasure and satisfaction to the transcontinental tourist at the end of his long journey that will make him feel well repaid for the fatigue of the trip and induce him to spend several weeks sightseeing in America's Switzerland—the Pacific Northwest.

Roads at Low Cost for Moderate Traffic

By F. E. EVERETT

State Highway Commissioner of New Hampshire

In these days of modern road building, when large sums of money are being expended for highway improvement, when any sort of so-called permanent type of pavement will cost from $10,000 to $30,000 per mile, many engineers and commissioners are brought face to face with the question of how the mileage necessary to complete their highway system can be built without bankrupting the state or county which they represent.

There is no doubt that the high class types of road are most esesntial and necessary on trunk lines or main roads between cities or county seats, that are subjected to all sorts of traffic from horse-drawn vehicles to motor trucks. But, outside of these main arteries, is it not necessary that a cheaper type of road be constructed? Even if a commonwealth can arrange a bond issue ample to construct its whole system of bituminous macadam, concrete or brick pavement, is it not economy for it to construct a less expensive road? I say emphatically, yes, and I think I can best illustrate my ideas by giving you a sketch of the methods that have been employed in building up the department of the state which I represent.

First, I will sketch the history of the highway work.

Second, the methods of construction of our so-called gravel roads.

Third, maintenance.

Previous to 1905 New Hampshire had no highway department. Various sums of money had been appropriated for the maintenance of different pieces of road. Most of these appropriations were for sections in the White Mountain district and in unincorporated townships where there was no local town government. The expenditure was left to various individuals—from special committees appointed by the Legislature to local engineers and selectmen.

There could be but one result from such a method of procedure, so that when all road matters were placed under one head it was impossible to tell where the various appropriations had been expended.

In 1905 Arthur W. Dean, now Chief Engineer of the Massachusetts Highway Commission, was made the first state engineer, and through his untiring efforts a most comprehensive plan of state aid was worked out and put into effect. This plan provided that each town should set aside a certain sum of money for permanent improvement, this amount varying from $1.00 on each $1,000 for towns having a valuation of less than $2,000,000 to $.25 on each $1,000 for towns having a valuation of $15,000,000 and upwards, this fund to be expended under the direction of the state engineer.

In addition to this, if a town wished for state aid, it must set aside an additional amount equal to 50 per cent. of the amount required for permanent improvement. The state's apportionment to this fund varied from $3.00 to each $1.00 for towns having a valuation of less than $100,000 to $.20 for each $1.00 for towns having a valuation of $3,000,000 and upwards. To meet the state's share of this fund, the law provided for an annual appropriation of $125,000.

As this fund could be expended on any main road between township centers, the result of four years of state aid was a considerable mileage of built road, but in short sections and on various and sundry main roads. What one town would consider its main artery might be of no particular benefit to a neighboring town. This showed us that in order to get anything like a continuous road, we must amend or modify the original law. This was accordingly done, and the Legislature of 1909 authorized the designation and construction of three main lines, north and south through the state, all towns through which any of these lines passed to receive at least $1.00 for $1.00 and they could not have state aid on any other road until the trunk lines were built.

It further provided for a bond issue of $1,000,000, of which $200,000 should be available each year for five years. The last payment however, was made by direct appropriation and the state has made two additional appropriations one for $200,000 and one for $300,000.

At the time of the establishing of the department, we were confronted with many obstacles not the least of which was the cost of construction of a permanent highway. Many of our good citizens would lift their hands in horror at the thought of spending $5,000 for a mile of road. That meant more money than the majority of the towns in our state expended on all their roads for the year. It was, therefore, up to the department to build a cheaper road and at the same time get a road that was satisfactory to the traveling public. Then again many of our towns, in fact the majority, are isolated from the railroad or at such a distance from stone quarries as to make a macadam road prohibitive.

Also New Hampshire might be termed a "vacation state." The White Mountain region is the mecca of a great number of tourists from all over the United States. The motorist is not satisfied to have one improved road to travel on. He does not like to return the same way he goes. He wishes a continuous change in scene.

With our present completed system the tourist can reach the mountains by any one of three routes and return by either of the other two, but had we been obliged to confine ourselves to a high class type of construction, we could have made but a poor showing on any one of these routes, to say nothing of building three. In the building of these three lines we have resorted to the material we had at hand. In a good many localities there are deposits of good gravel and where this occurs it has been comparatively easy to get good results. In numerous other places gravel could not be found or if found it was of an inferior quality lacking in some important feature, perhaps in binding material, perhaps as is more often the case, in metal.

Under these conditions we resort to a combination of material to get the desired effect. If the gravel is sandy, with no binding material we alternate the layers of gravel with clay or marl or sometimes mix the two materials thoroughly by harrowing or some such other method. If there is not enough metal we have found that with a stone foundation, material of a very inferior quality can be used for surfacing and with very satisfactory results.

We have in New Hampshire a mixture of clay and sand and gravel called hardpan. This is probably more common than any other native material. This material mixed with sand or sandy gravel or even laid directly on the stone foundation or telford is quite satisfactory under our system of maintenance.

Construction

In construction we pay due attention to the essentials—alignment, grading, drainage and foundation. In connection with the alignment it may not be out of place to say just a word as to our methods of survey. Contrary to the general practice adopted by most states, we do not make a plan of the road first and then plot the new road on paper.

The first procedure is to establish the center line of the new road on the ground, correcting the old alignment where possible. With this as a base line we are enabled to stake out the new layout and also make a survey of the existing conditions. Stakes are set every 50 ft. on an offset from the center line. When the cross sections are taken an elevation is obtained of the top of these offset stakes so that when the finished grade is obtained it is easy to determine the cut of fill from the top of these stakes.

If for any reason it is desired to change the alignment after the survey is plotted on the plan, the stakes are on the ground and it is an easy matter to figure the offset either way from them. I believe this method of survey and staking out saves the expense of one engineering operation in the field.

The essentials of drainage and foundation we give particular attention to, for with these gravel or dirt roads it is very necessary that the water be thoroughly taken care of. A great many of our roads have the telford foundation, especially if the gravel is of an inferior quality with a tendency to be heavy or sticky in wet weather.

While in many sections there is a scarcity of good gravel, we are blessed with an abundance of stone. In fact it is believed by many of our people that the Lord used New Hampshire for a dumping ground after he had used what he needed in building the rest of the world. However true this may be, we certainly appreciate the fact that we have them.

We have built most of our roads 21 ft. wide from ditch to ditch. No doubt many of you will say that this is not wide enough. In some cases I am inclined to think so myself. However, they have answered very well for the traffic they are subjected to. Our original specifications called for 15 ft. of metal and 3-ft. dirt shoulders. The gravel was laid in three courses of sufficient thickness to make the whole compacted mass 8 ins.

Today we believe that we can get better results by subgrading the entire width of 21 ft. in practically a flat section. If, however, the stone fundation is used we crown it slightly. On this section the surfacing material is placed in two courses, using a dumping board or dumping the loads in such a way that all the material will be handled over.

We desire to roll each layer, using in most cases a horse-drawn corrugated roller. Some of the larger towns, however, use a steam roller and some of the smaller ones have no roller and depend on the traffic to do the compacting, keeping it in shape by dragging and raking. Of course we get results quicker where we are able to use a sprinkler and thoroughly wet down the separate layers, but in most cases we have to depend upon nature for the wetting. The finished section has a thickness of metal of about 10 ins. in the center and practically nothing on the edges. This gives a crown to the road of about 1 in. per ft., which we believe is necessary for roads of this nature.

We have built in the ten years that the department has been in existence, 1,171 miles of road of which 558 is trunk line, outside of the compact portion of towns having a population of over 2,500. Of this latter amount 422 miles are of gravel construction and represent an expenditure of $1,614,503, or an average per mile of $3,826.

Maintenance

After any road has been properly rolled and the surface has been made compact and smooth, it is desirable that it should always be maintained in that condition. It is a common rule that the finest roads are the result of good construction and system of maintenance whereby every defect is corrected before it has time to cause serious damage. This rule is chiefly applicable to a gravel road for the very obvious reason that if we are to build gravel roads and expect them to give their users the same satisfaction that the more expensive types would give, we must maintain as near a true section as is possible, free from ruts and holes.

The question next arises what kind of maintenance will accomplish this result. As we all know there are two general forms of maintenance, which may be called continuous maintenance and periodical repairs.

It is not my purpose to analyze the merits or defects of these systems. Both have their advocates and critics and both their strong and logical argument. Personally, I feel that both systems are correct. The type of road to which they are applied should regulate their selection. It would certainly be a waste of money to employ constant maintenance upon a high class pavement which we have every reason to expect will wear uniformly until such time as to need resurfacing. On the other hand it would be poor policy to let a gravel road go until it needed resurfacing.

It is important that every rut and hole be filled as soon as they appear for they will hold water which will soften the gravel bed and cause the road to wear rapidly.

The question now arises: What is the best method to adopt to accomplish this continuous maintenance? There could be only one answer to this so far as the gravel road is concerned, namely the patrol system. A patrolman equipped with a one-horse hitch, shovel, rake and drag, etc., given a mile of road per diem, will find plenty to do. A gravel road to insure the maintenance of its cross section should be dragged after every rain. Under the periodic system we could not do this as it was impossible to have the maintenance gang at the proper places at the proper times.

As we all know, a gravel road can be too wet or too dry to drag. In other words there is a certain time after a rain when the road is in the best possible condition to work and obtain results. The patrolman constantly on the road is going to know just when this time arrives. He is going to discover the weak places. He will see the small hole when it starts and before it has developed into a large one or a series of small ones. He can patch the roads in the early stages of disintegration without serious trouble or excessive cost.

Theoretically, if a patrolman gives his gravel road proper attention it should never need resurfacing. He will cart on and distribute enough new gravel to take the place of that which has been worn out under traffic. The patrolman fully illustrates that old adage, "A stitch in time saves nine."

As an illustration of the favor in which we hold the patrolman's services, I will cite the increase that has been made in this branch of our organization. In the year 1911 there were two men employed as patrolmen on one of our trunk lines for about two months. This was our first attempt with the patrol system. We have already appointed, for the year 1916, 225 patrolmen. These men will be employed from April 1, or sooner if the weather conditions permit, until December 1. Their average pay will be $3.25 per day. Now arises the question: How much money can be justifiably expended in the maintenance of a gravel road?

An article published in the "Engineering News" of December 9th, 1915, answers this question to perfection.

"Assuming the cost of a modern country road pavement of the so-called permanent type at $15,000 a mile (conservative) and supposing this to be paid for by 20-year bonds at 4½ per cent., the annual charges for interest on and redemption of the bonds amount to about $1,150 per annum. It is safe to assume that even the most 'permanent' type of country road pavement will require repairs and maintenance of at least $50 per mile per year, or in round figures we have a minimum of $1,200 per mile per year as the cost of the improved road.

"Assuming that a good gravel road may be built for $4,000 per mile" (which we have shown is more than the average cost of New Hampshire roads), "the annual charges for interest on and redemption of bonds (if the roads are built by bond issues) at the end of 20 years would amount to about $310. Therefore, it is theoretically economical to spend nearly $900 per mile per year for the maintenance of gravel roads, if for that sum the roads can be maintained in a condition equal to a pavement in the $15,000-a-mile class."

Our claim is, that in New Hampshire, we are able to maintain this condition on four-fifths of our roads. This four-fifths carries an average traffic of about 300 to 600 vehicles, mostly motors, per day during the vacation season.

From the comparison just cited, we find that we can economically spend $900 per mile per year for maintenance. Under the patrol system we do not find this expenditure necessary. Taking forty towns in New Hampshire whose state roads have been built of gravel and maintained by the patrol system, we find that in the year 1915 our average cost of maintenance per mile was $240. This cost includes in some cases the surface application of a light asphalt or non-asphaltic oil. I will leave it to your judgment if this type of road is not the most economical for moderate traffic.

A doubt will probably exists in the minds of some when they take into consideration the amount of traffic that these roads carry and compare it with some of the elaborately worked out theories as to the wearing qualities of plain gravel roads, but we have the experience of several years of this type of maintenance and construction as a refutation.

In fact any of these gravel or so-called combination roads, which were originally built of necessity, have worn so satisfactorily that today we are advocating this sort of construction as a principle. We believe that for four-fifth of our trunk line roads this type of construction is absolutely satisfactory for moderate traffic, if properly maintained, and by far the most economical road to build.

Recent Developments in the Building of Concrete Roads

By **WILLIAM D. UHLER**

Chief Engineer, Pennsylvania State Highway Department

Road authorities are paying more attention today, than ever before, to the details of construction, in an endeavor to find a form or type of construction that not only will withstand present day traffic, but which also will be economical in first cost and low in maintenance charges. With this object in view, experimental and service test roads are being built from time to time.

To determine the practicability of such construction, and to assist in standardizing the best design and most approved methods of construction, the Pennsylvania State Highway Department has undertaken, with the cooperation of the cement interests, to build a model concrete road between Easton and Allentown, approximately twelve miles in length.

In the construction of this highway, which is not yet completed, especial attention is and has been paid to every engineering detail, starting with the subgrading and drainage, thorough rolling of subgrade before placing materials, proper grading of aggregates, the exact proportioning of materials and the amount of water used. Other details closely watched are the timing of the mix, laying of the concrete, striking off and curing of the pavement.

After the subgrade is finished accurately, drained and rolled, the forms are placed, which consist of 6-in. channels in 12-ft. lengths, held in place by steel pins; particular care being taken to have the alignment and grade of these forms accurate. The steel forms are being used both for economy and on account of the ease with which they can be handled.

To eliminate the re-handling of materials, a system was devised for the proper distribution of the aggregate and cement. On this work all materials have been brought to the point of use on trolley cars, advantage being taken of the fact that the car tracks paralleled the full length of the road, making it by far the most economical way of handling the materials. This method of delivery proved advantageous for unloading sand and stone at measured intervals. Portable canvas sheds, holding 90 sacks each, used for the storage of the cement, were placed at measured distances along the route, and as emptied were moved ahead.

In proportioning the batches, the sand and stone were handled in specially devised wheelbarrows, of 3 cubic feet capacity, to insure accurate measuring, and when loaded these barrows were struck off with a shovel. The same care has been given with reference to the amount of water used in each batch, just enough being put in to secure a plastic mixture which would not quite level down in the bucket when dumped.

Every batch of concrete is mixed for one and one-half minutes; the reason for this being that a number of experiments, made during the progress of the work, indicated that the greatest strength, commensurate with economy in cost of mixing, was obtained from a mix of this timing. The experiments which resulted in this conclusion were as follows;

½ min. mix.....	9 revolutions,	8 day test,	1,400	lbs.	per sq. in.
1 min. mix......	17 revolutions,	"	1,587	"	" "
1½ min. mix....	26 revolutions,	"	1,926	"	" "
2 min. mix......	36 revolutions,	"	1,661	"	" "
3 min. mix......	51 revolutions,	"	1,673	"	" "

This shows that if these results are plotted, the curve would break between the one and one-half and the two minute periods. If the accuracy of the results on the one and one-half minute mix be questioned, and this figure assumed to lie between 1,587 and 1,661, the results plotted so as to form a curve will show that the rate of increase in strength decreases with increase in the time of mix, and the increase obtained from the two and three-minute periods is scarcely worth the additional time and cost involved.

Another feature that has been brought out in connection with this work is the great variation in strength of 6-in. cubes of the regular mix, made up daily during the progress of the work, and set aside for testing at periods of seven, fourteen and twenty-eight days and six months.

The seven-day compression test runs from 1,065 to 3,633. The fourteen-day test, from 1,572 to 4,212. The twenty-eight day test, from 2,362 to 5,361. As yet, no six-month breaks have been made.

These wide variations in strength values may be due to a combination of several causes, including variations in the quality of the cement and mineral aggregates; difference in storage temperature (some of the specimens having been made up during warm weather and some during very cool weather); possible slight differences in the mix, and differences in the molding and compacting of the specimens; and finally, of course, the unavoidable experimental variations in making and breaking the specimens.

Since every one of these factors, except the last named, enter into the actual construction work, the importance of systematic testing of the cement used, examination of the sand and stone (particularly with reference to grading), and strict adherence to uniform, approved methods of mixing, placing, compacting, and curing the concrete in the pavement, are forcibly demonstrated by the range in these daily strength values.

Before placing the concrete, the subgrade is thoroughly sprinkled, after which the concrete, mixed in the proportions of 1:2:3, is placed to a depth of 6 ins. at the side and 8 ins. in the center, and then struck off with strike boards. A heavy strike board is used first, followed by a lighter one, which results in the compacting of the concrete and the elimination of waves or rolls in the surface. The striking off always should be done in the same direction as the progress of the work. When the strike board proceeds to within 3 ft. of the joints, it is lifted and placed alongside of the joint filler, or installing bar, and then worked away from the joint. This avoids the danger of piling up material around the joint or pushing the joint out of perpendicular. Joints which are not perpendicular may cause unevenness due to one slab rising on another. Proper striking off puts the surface in condition to be finished with the least amount of labor, as well as making it possible to secure an even, true and dense pavement.

After the water has disappeared, the surface is floated with a wooden float. Too frequently it is the case that the floating is done prematurely and this has a tendency to bring the fine light particles to the surface, which offers little, if any, resistance to abrasion.

Joints, ¼ in. wide, are provided at intervals of from 36 to 40 ft. These are filled with a prepared bituminous material, ¼ in. thick and 9 ins. wide, placed in accordance with the standard practice of today. The concrete on either side of the joint is finished with a split float, which gives a surface of even height on both sides of the joint and overcomes to a great extent the so-prevalent rough riding joints. The edges of the joints are then rounded with a 3/16-in. edger to prevent the spalling or breaking of the edges. The bituminous joint material is trimmed off about 1 in. above the finished surface, which permits traffic to beat down the projecting filler, thus forming a protection to the edges.

The sides of the slab are then rounded with a ¾-in. edging tool, which not only adds to the appearance of the work, but serves to protect the sides and prevents chipping by traffic turning on and off the road.

There is a vast difference of opinion as to the advisability of using protection plates at the joints. Experience leads me to believe that if proper care is taken in the maintenance of the unprotected joints, built as outlined above, far more satisfactory and economical results will be attained than by the use of steel joints, especially if there is any difference in the rate of wear of the concrete and the steel in the joints. Only a thousand feet of this road has been constructed with steel protection joints, and up to the present time no advantage in this method of protection is noticeable.

The road in question, although of 6-in. and 8-in. construction, is reinforced also with a light metal fabric, which is shipped to the job in sheets 5 ft. in width, and 6 and 10 ft. in length. This is placed with longtitudinal joints staggered and with a lap of 4 ins. crosswise and 12 ins. longtitudinally. Of course, it would be preferable if sheets could be obtained the full width of the roadway. Reinforcing shipped in sheets, in my opinion, is more satisfactory because it is easier to handle and can be installed with less trouble, while with the rolls there is bound to be more displacement of the concrete when the workmen endeavor to force it into place.

This metal reinforcement is placed 2 ins. below the top of the slab. It reduces the number and size of the cracks and is designed also to overcome longtitudinal cracks, which may occur because of the settlement of the shoulders.

Throughout the West the general practice is to build concrete roads, without reinforcement, 6 ins. at the side and 8 ins. in the center. Personally, I believe that far better results can be obtained at the same cost, and under some condition at less cost, by the construction of 5-in. and 7-in. concrete roads, with light metal fabric reinforcement.

In order to secure the maximum strength and wearing qualities, special attention is given to the curing and protection of the concrete pavement. During hot and windy weather the fresh concrete is covered with canvas as soon as possible after floating. To keep the canvas off the fresh concrete, portable forms were constructed, which could be taken up and set along the edges of the pavement, projecting about 12 ins. above the pavement on which the canvas covering, which was on two rollers, was easily unrolled. This method of handling the canvas covering proved very satisfactory. After the concrete had had sufficient time to harden, the canvas was removed, and the pavement covered with from 2 to 3 ins. of earth and kept wet from 10 to 14 days. The ponding method of curing, employed by the Highway Department of California, permits the flooding of the pavement and is more economical and far more satisfactory but due to the character of our soils it is not practicable in this section of the country.

At the expiration of the fourteen-day limit, the earth covering was removed and the road thrown open to traffic.

Of this twelve miles just described, a section about three and one-quarter miles in length was completed last season. An inspection made recently shows that thus far only two slight cracks have developed in the pavement.

Other experiments will be made on this work during the coming season, with reference to the time and speed of mixing and also the water consistency.

In order to make a more complete study of the cause of cracks in concrete pavements, three lines of precise levels have been run taking elevations at each end of every slab, at each corner, and in the center. This should give us some valuable data, and in case longitudinal cracks occur, enable us to determine whether there has been a heaving, due to frost action, or a settlement of the shoulders.

And, finally, I would say that the essential features for a good concrete pavement are a hard, dense surface, true to grade and cross section, free from waves, depressions and irregularities, and one which will insure uniform wear.

NEWS NOTES

Friday, March 10, Will Be Observed as Good Roads Day by the country schools of Illinois.

The City Commission of Salt Lake City, Utah, has approved a paving program involving the expenditure of $125,275.

The Commercial Club of Salem, Ore., has gone on record as favoring the expenditure of $1,000,000 a year for a period of ten years on highways in the forest reserves of Oregon.

The Voters of St. Louis County, Mo., have voted in favor of a bond issue of $3,000,000 for the construction of county roads and bridges. The matter has been noted in several previous issues of "Good Roads."

New New Jersey Legislature has been asked for an appropriation of $100,000 to start the work of freeing the toll bridges across the Delaware River. Pennsylvania has already made an appropriation for this purpose.

The Sixth American Good Roads Congress

The Sixth American Good Roads Congress, comprising the Thirteenth Annual Convention of the American Road Builders' Association and the Seventh National Good Roads Show held under the auspices of that organization, was held at Pittsburgh, Pa., on February 28, 29 and March 1, 2 and 3.

The attendance was large and consisted to an even greater extent than usual of those actually engaged in some part of road or street work. There were representatives, official or otherwise, from practically every state and from many of the provinces of Canada and from many foreign countries. The attendance at the technical sessions was remarkably large, the hall being practically filled at almost every session.

The Good Roads Show comprised a large number of exhibits, the displays including practically every machine or material used in the construction or maintenance of country roads or city streets. The show was one of the most successful ever held, both from the point of view of the delegates and the exhibitors.

An account of the congress and a list of the exhibitors follows.

MONDAY, FEBRUARY 28

Public Meeting

A public meeting was held on the evening of Monday, February 28, at Memorial Hall, and was attended by several hundred delegates and guests, including many prominent men of Pittsburgh, Allegheny County and Pennsylvania, as well as many well known men from other states. Music preceded and followed the exercises, which consisted of addresses, James Francis Burke, former member of Congress, acting as chairman. Addresses were made by Governor Major of Missouri; Dorsey W. Shackleford, Member of Congress from Missouri and chairman of the House Committee on Post Offices and Post Roads; former State Highway Commissioner Edward M. Bigelow of Pennsylvania, and former Secretary of State Philander C. Knox.

TUESDAY, FEBRUARY 29

First Session

President Stevens called the opening session to order at about half-past eleven, Tuesday, February 29, introducing as the first speaker, Mayor Joseph G. Armstrong, of Pittsburgh. The Mayor spoke very briefly, welcoming the convention on behalf of the city. In the course of his remarks he referred to the highways of Pittsburgh and vicinity and expressed the hope that the delegates and guests would have an opportunity to see the residence districts.

At the conclusion of Mayor Armstrong's address, President Stevens announced that Governor Brumbaugh was unable to be present. In his place he introduced County Superintendent of Highways R. S. McDowell, of Chester County, Pa., who briefly extended the welcome of the State of Pennsylvania. He also called attention to the magnitude of good roads work and the need for cooperation in carrying it on.

The welcome on behalf of the Pennsylvania State Highway Department was extended by First Deputy State Highway Commissioner Jos. W. Hunter. Mr. Hunter spoke briefly, but presented considerable information relative to the highway work of the state.

The next speaker was President D. P. Black, of the Pittsburgh Chamber of Commerce, who welcomed the delegates on behalf of that organization. Mr. Black's address consisted largely of an interesting resume of the history of Pittsburgh, with especial reference to the influence of roads.

Mr. Black was followed by County Commissioner A. C. Gumbert, of Allegheny County. Mr. Gumbert briefly welcomed the delegates on behalf of the county.

Governor Major of Missouri followed Mr. Gumbert. In the course of his address, he urged that road work be put into competent hands and that funds be appropriated liberally.

At this point President Stevens made the response on behalf of the American Road Builders' Association. His address follows.

Presidential Address by Col. E. A. Stevens

I cannot better acknowledge the kind words of welcome with which this Association has been received in this city which typifies the growth and spirit of industrial America as does no other community, better than by expressing the hope that this convention may mark another step forward in the great work which the people of these United States have undertaken in the betterment and modernizing of their highways and by voicing our determination to achieve so desirable an advance.

This great country of ours is not going mad over a proposition to build parkways upon which well dressed ladies may air their lap-dogs in the luxury of a ten thousand dollar imported car.

The task of raising and spending the billions necessary for the proper system of roads that our industrial development loudly demands is a serious business proposition. It represents an investment too long delayed and one whose importance is each day more strongly emphasized by the triumph of the American engineer and mechanic in the production of the motor vehicle. The road problem is fast reducing itself to one of dollars and cents; to producing roads that will carry given weights at the smallest cost. It is in this very aspect of the case that the efforts of associations of men drawn together by their interest in roads can be usefully exerted and when, to the interest that is common to all enlightened citizens, there is added special knowledge in the actual work of designing, building, maintaining and financing roads, a special capacity for valuable service exists that entails a duty to the commonwealth.

The work of persuading the people that they need good roads in their daily business is almost done. The stern logic of the survival of the fittest is beginning to make itself felt in those communities that have neglected their highways. This inexorable law of nature will soon make its results so plain that no other argument will be needed. What is needed today is not the preaching of the gospel of good roads; nor is our great need the discovery of that impossible myth, the one best road for all conditions.

The underlying principles of road construction are as fairly well known as is any problem of design in these days of rapid changes and dazzling progress in engineering practice.

In the press of insistent demands for good roads it has been and it is hard to get above the mass of technical detail, the close and accurate study required for each new design and the web of red tape that is but too apt to hamper all public work. Yet above these we must rise if we are to do full justice to our job. We must face, weigh, discuss and determine on those principles that must furnish the foundation for a successful administration of our roads. For this we must have interchange of experiences and ideas. Such is the purpose of this convention. From a neglected and unimportant link in our great system of transportation, our highways are fast becoming a system rivaling our railways in importance. They deserve and they must receive the same characteristically American treatment if they are to yield the return which the people and the industries of this country are entitled to receive. It has always been characteristic of the American—and above all of the American engineer—that whatever study he may devote to the practice of older nations, he works out, adapts and adopts for his purposes a solution indicated by the peculiar conditions under which his work must be done, for which it must stand the test of service and in the stress of which it must make good.

In the case of our roads it is especially true that these conditions include not only the physical and industrial features, but the peculiar mental attitude of the people and their political organization and traditions. It is a worn truism to say that we must keep politics out of our road work. The question is: How are we to do it? In the right answer to this question it seems to me we shall find many of the principles which we must recognize as necessary to the solution of our problem. To me it seems useless to expect to end the demoralizing effect of a spoils system of patronage, of "log rolling" and of the "pork barrel" unless we can put the work in the hands of a body of men who by their personal character, trained ability and devotion to their work will earn and deserve the confidence of the public. Such a body of men does not grow on the bushes. The individuals exist today—to make an effective force these must be organized, trained to act for one end and imbued with that spirit of team work that makes the successful combination of men, be they a football team or the force of one of the great mills of this city.

GROUP OF DELEGATES AND GUESTS AT THE THIRTEENTH ANNUAL CONVENTION OF THE

Such a force will be at its best only when it can point to the results of its work; when each unit can compare its useful output with that of its neighbor and devise new ways of effecting savings or increasing returns.

I had the honor of calling the attention of this Association to one aspect of this need at the annual meeting. That detail, namely the establishing of a traffic unit which would express the value of the return given by the road, with due regard not only to the weight transported but to the speed at which it is moved, acquires its importance not as a mere piece of curious information but because without it we shall never express the true value of road work. Without this unit we can never prove to the American people that their road forces should not be tampered with, should not be expected to furnish soft berths for the deserving of any political party and that they can be relied on to do their duty and yield a return if they be given the chance.

The job as a whole is worthy of great men; worthy, for example, of such great administration engineers as Pennsylvania has produced in Fritz and Taylor; worthy of the organizing power that has made Pittsburgh synonymous with productive efficiency.

It is to a step forward in this work that I, as its President, am pledging this Association under the auspices and inspirations to be drawn from your surroundings, your traditions and from your kindly words of welcome.

After the response by President Stevens, brief addresses were made by W. A. McLean, Deputy Minister of Highways of the Province of Ontario, Canada, and F. E. Everett, State Highway Commissioner of New Hampshire.

Second Session

The second session of the convention was called to order at 2:30 p. m., President Stevens in the chair.

The first speaker was R. Keith Compton, Chairman and Consulting Engineer of the Paving Commission of Baltimore, Md., who presented a paper on "Railway Track Construction in Paved Streets." W. H. Taylor, Jr., City Engineer of Norfolk, Va., who was scheduled to open the discussion, was unable to be present because of illness. The paper was discussed by H. W. Durham, County Engineer of Bergen County, N. J., and formerly Chief Engineer of Highways of the Borough of Manhattan, New York, N. Y.; J. M. Larned, Engineer of Way, Pittsburgh Railways Co.; Gordon Campbell, President and General Manager, York Railways, York, Pa., who represented the American Electric

Railway Association; J. Toner Barr of the Pittsburgh Chamber of Commerce; E. B. Ulrich, City Engineer of Reading, Pa.; W. M. Kinney, Inspecting Engineer, Universal Portland Cement Co., and others.

In the absence of Chief Engineer N. S. Sprague of the Pittsburgh Bureau of Engineering, his paper on "The Control of Openings in Pavements" was read by title. It was discussed by George E. Datesman, Director of Public Works, Philadelphia, Pa., and H. W. Durham.

After the discussion of Mr. Sprague's paper, President Stevens announced the appointment of the Committee on Resolutions and the Committee on Credentials. These committees were as follows:

Committee on Resolutions: Geo. W. Tillson, N. Y., Chairman; Charles Whiting Baker, N. Y.; Maj. W. W. Crosby, Md.; F. E. Ellis, Mass.; F. E. Everett, N. H.; W. A. McLean, Ontario, Canada; James H MacDonald, Conn.; R. L. Morrison, Texas; and Wm. D. Uhler, Penn.

Committee on Credentials: R. A. Meeker, N. J., Chairman; R. H. Gillespie, N. Y.; R. K. Compton, Md.; J. M. McCarthy, Mass.; J. W. Hunter, Penn.; Col. S. D. Foster, Penn.; J. R. Wilson, W. Va.; M. B. Greenough, Ohio; M. H. Crump, Ky., and Alfred Clark, N. H.

AMERICAN ROAD BUILDERS' ASSOCIATION, AT PITTSBURGH, PA., FEB. 28—MARCH 3, 1916

After the announcement of the committee appointments the convention adjourned until 10:00 a. m., Wednesday.

Theater Party

On Tuesday evening the members of the association and other delegates were guests of the Pittsburgh local committee at a theater party at the Nixon Theater. The play was "Rio Grande," a new drama by Augustus Thomas. At the end of the third act Mr. Thomas responded to repeated calls for the author and made a brief speech in which he alluded to good roads.

WEDNESDAY, MARCH 1

Third Session

The third session of the convention was called to order at about half-past ten, by First Vice President A. W. Dean. The first paper scheduled, "Recent Developments in the Building of Concrete Roads," was presented by W. D. Uhler, Chief Engineer of the Pennsylvania State Highway Department. The remainder of the session was taken up by a spirited discussion on the paper the points especially emphasized being the life of concrete pavements, the qualities of various aggregates, the methods of inspection and the grades upon which concrete pavement can be laid. Among those who took part in the discussion were R. L. Morrison, Professor of Highway Engineering, Texas Agricultural and Mechanical College; H. B. Shattuck, Assistant Professor of Railroad Engineering, Pennsylvania State College; Anthony Bowen, Mayor of Fairmount, W. Va.; K. H. Talbot; Harvey Linton, of Altoona, Pa.; C. H. Roper, President of the Omaha, Lincoln and Denver Highway, Lincoln, Neb.; B. Woodyard, Parkersburg, W. Va.; W. M. Kinney, Inspecting Engineer, Universal Portland Cement Co.; John T. Harrop, Supervisor of Roads, Bergen County, N. J.; A. T. Chollar, of the Association of American Portland Cement Manufacturers; T. J. Jones, City Engineer, Brantford, Canada; Charles Whiting Baker, Editor of "Engineering News;" Wm. M. Acheson, of the New York State Highway Department; F. W. Patterson, Cleveland, Ohio; James H. MacDonald, formerly State Highway Commissioner of Connecticut; R. A. Meeker, State Highway Engineer of New Jersey, and others.

Fourth Session

The afternoon session was called to order at about half-past two by President Stevens.

The first speaker was John H. Gordon, of Albany, N. Y., who read his paper, "A Contractor's Suggestions to Engineers and Inspectors." The subject was discussed by F. E. Ellis, of Melrose, Mass.

F. C. Pillsbury, Division Engineer, Massachusetts Highway Commission, who was scheduled to present a paper on "Adaptability of Paving Materials to Different Conditions and Localities," was not present. After announcing this, President Stevens called upon F. P. Smith, of Dow & Smith, New York, N. Y., who read a discussion on Mr. Pillsbury's paper. E. B. Ulrich, City Engineer of Reading, Pa., and others participated in the discussion.

The next paper of the session, "Roads at Low Cost for Moderate Traffic," was presented by F. E. Everett, State Highway Commissioner of New Hampshire. C. R. Wheelock, of Orangeville, Ont., who was scheduled to open the discussion, was unable to be present The subject was discussed by Chas. H. Neal, County Engineer of Buncombe County, N. C., A. W. Dean, Chief Engineer, Massachusetts State Highway Department, and Jos. W. Hunter, First Deputy State Highway Commissioner of Pennsylvania.

At the close of this discussion, the paper, "Foundations for Roads and Streets," scheduled for Friday, was presented by the author, Jos. W. Hunter, who could not be present Friday. K. H. Talbot, R. L. Morrison, C. H. Neal, W. M. Kinney and J. S. Pardee discussed the subject.

At the close of the discussion, Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City, spoke at some length on Commissioner Everett's subject. He was followed by W. M. Kinney, F. E. Everett, J. W. Hunter and others.

Annual A. R. B. A. Dinner

The annual A. R. B. A. dinner was held in the English Room of the Fort Pitt Hotel on Wednesday evening and was attended by several hundred members and others. President Stevens of the A. R. B. A., presided, and called upon Mayor Armstrong of Pittsburgh, former State Highway Commissioner E. M. Bigelow of Pennsylvania, and former State Highway Commissioner James H. MacDonald of Connecticut for brief speeches. An orchestra played during the dinner and afterwards, and the diners sang under the leadership of a professional leader. There was also a cabaret entertainment.

THURSDAY, MARCH 2

Fifth Session

The fifth session was called to order soon after eleven o'clock by President Stevens, who introduced as the first speaker First Deputy Commissioner H. E. Breed of the New York State Commission of Highways. Mr. Breed read his paper, which was entitled, "Brick Streets and Roads." The subject was very thoroughly discussed, those participating being C. H. Roper, C. H. Neal, County Engineer of Buncombe County, N. C.; M. B. Greenough, Instructor of Civil Engineering, Case School, Cleveland, O.; Chas. Whiting Baker, Editor of "Engineering News;" Wm. C. Perkins, Chief Engineer of the Dunn Wire-Cut Lug Brick Co.; W. M. Kinney, Major W. W. Crosby of Baltimore, F. E. Ellis, P. Ridge and others.

In the absence of Charles F. Knowlton, Manager of the Paving Department of the Simpson Bros. Corp., of Boston, Mass., who was to present the paper on "Recent Tendencies in Stone Block Pavements," the paper was read by title. The discussion on stone block pavements was opened by H. W. Durham, County Engineer of Bergen County, N. J. A. T. Rhodes, Superintendent of Streets, Worcester, Mass.; E. I. Hannah; Major W. W. Crosby; Z. W. Carter, Secretary of the Granite Paving Block Manufacturers' Association, and others also took part.

The last paper on the program, "The Function of Stone in the Bituminous Concrete Pavement," was read by the author, R. B. Gage, Chemist of the New Jersey Department of Public Roads. The discussion following the presentation of the paper was participated in by Herbert Spencer, Chas. W. Dill, R. H. Gillespie and others.

Automobile Trip

On Thursday afternoon many of the delegates and others in attendance were the guests of the Pittsburgh Chamber of Commerce and the Automobile Club of Pittsburgh on an automobile ride. The delegates were taken over Grant Boulevard and other streets to Schenley Park, through that park and through Highland Park, returning to the city over Baum Boulevard. On the way back to the city a short stop was made at the rooms of the Automobile Club.

Business Meeting

A business meeting of the A. R. B. A. was held after the delegates had returned from the automobile ride.

President Stevens, who presided, called the meeting to order shortly after four o'clock. The reading of the minutes was dispensed with and the meeting passed to the consideration of the report of the Committee on Resolutions, the principal business of the meeting. The report was read by Chairman Tillson, section by section, and adopted as read. The resolutions follow:

Resolutions

RESOLVED, That this Association expresses its appreciation of the cordial welcome extended to it by His Excellency, the Governor of the State of Pennsylvania, His Honor the Mayor of Pittsburgh, and the Pittsburgh Chamber of Commerce.

RESOLVED, That this Association extends its sincere thanks to the state, county and city officials, the commercial organizations of the city and especially to the Pittsburgh Chamber of Commerce for its very delightful theater party, and the Pittsburgh Automobile Club for its very enjoyable automobile ride, as well as the different organizations which are devoting their attention to road improvement, for the many courtesies extended by them, all of which have contributed so conspicuously to the enjoyment and profit of those in attendance at this convention.

RESOLVED, That this Association hereby expresses its appreciation of the valuable cooperation of the manufacturers, states, cities and all others who have, by their excellent exhibits and efforts, contributed so greatly to the value and instructiveness of this convention.

RESOLVED, That this Association recognizes the value of the work done both by the local and general press in disseminating information regarding this convention and it hereby tenders its thanks for the same.

RESOLVED, That this Association invites the attention of all state, county and all municipal authorities to the value of traffic censuses as a means of recording and determining the relative values of various forms of pavement and road construction and would strongly recommend that systematic traffic censuses be taken from time to time on all classes of roads and pavements in order that more definite knowledge of the economic value of the different types of construction may be obtained.

RESOLVED, That in taking such censuses separate counts should be made of horse-drawn vehicles, light and heavy, and of motor vehicles, classified as pleasure and commercial cars, with notes as to the use of especially heavy trucks and vehicles with tires especially injurious to roads.

Where it can be used, in order to obtain comparable information, the standard form for taking traffic censuses reported by a committee of the American Society of Civil Engineers is recommended.

RESOLVED, That where funds for road construction are raised by an issue of bonds, this Association urges that the serial form of bond, by which a part of the principal is paid off each year, be adopted in preference to bond issues to be paid by accumulations in a sinking fund.

RESOLVED, That this Association urges that laws be passed and enforced in each state establishing reasonable limits for the weight, dimensions and speed of heavy motor vehicles.

RESOLVED, That in the matter of military preparedness a system of properly located and improved roads is of vital importance.

RESOLVED, That this Association heartily congratulates the City of Pittsburgh, County of Allegheny, State of Pennsylvania, and the public in general upon the fact that the people of this country and Canada are realizing the importance and value of good roads and are showing as much interest in the best methods of their construction and maintenance as is evidenced by the attendance at this convention.

After the adoption of the resolutions, H. W. Durham moved the appointment of the Nominating Committee, as follows: Geo. W. Tillson of New York, chairman; C. H. Howes of Massachusetts; George H. Biles of Pennsylvana, R. A. Meeker of New Jersey, R. L. Morrison of Texas, M. B. Crump of Kentucky, and W. A. McLean of Ontario, Canada. The committee, as named, was appointed.

FRIDAY, MARCH 3

Sixth Session

The last session of the congress was called to order shortly after ten o'clock, Friday morning, by President Stevens. The paper entitled "The du Pont Road" was taken up first and was read by the author, Charles M. Upham, Chief Engineer of the Coleman du Pont Road. The discussion which followed was taken part in by P. Ridge, C. H. Roper, Major Crosby, J. M. Costello and others.

After the presentation of Mr. Upham's paper, N. S. Sprague, Chief Engineer of the Bureau of Engineering of Pittsburgh, read his paper on "The Control of Openings in Pavements." This paper was scheduled for presentation at the Second Session and was discussed at that time, but Mr. Sprague was unable to be present at the session and the paper was read by title only. It was discussed briefly by Major Crosby; Will P. Blair, Secretary of the National Paving Brick Manufacturers' Association; City Engineer T. J. Jones of Brantford, Ont.; R. H. Gillespie, and others.

The last paper of the last session of the congress, "The Columbia Highway," by Henry L. Bowlby, former State Highway Engineer of Oregon, was read by Lloyd McEntire, Division Engineer of the New Jersey Department of Public Roads, the author not being present.

After the reading of the paper, Chairman R. A. Meeker of the Committee on Credentials reported that the official representatives to the congress had included 448 road and street officials representing 27 states, two representatives from Russia, a number of delegates from Ontario, Ottawa and Winnipeg, representing Canada, and one delegate from Panama.

After this report the convention was adjourned sine die.

Exhibitors

A list of the commercial houses, states, cities and publications making exhibits follows:

Acme Road Machinery Co., Frankfort, N. Y.
Allegheny, County of, Pennsylvania.
Asbestos Protected Metal Co., Pittsburgh, Pa.
Asphalt Block Paving Co., Toledo, Ohio.
Atlantic Refining Co., Philadelphia, Pa.
Autocar Co., Ardmore, Pa.

Baird Machinery Co., Pittsburgh, Pa.
Baker, Jr., John, New York, N. Y.
Ball Engine Co., Erie, Pa.
Barrett Co., New York, N. Y.
Bitoslag Paving Co., New York, N. Y.
Bituminized Road Co., Kansas City, Mo.
Blaw Steel Construction Co., Pittsburgh, Pa.
Brinker Supply Co., Pittsburgh, Pa.
Buffalo Steam Roller Co., Buffalo, N. Y.
Buff & Buff Mfg. Co., Jamaica Plain, Mass.

Carey Co., The Philip, Lockland, Cincinnati, Ohio.
Cast Iron Pipe Makers.
"Cement and Engineering News," Chicago, Ill.
Chase Co., F. L., Columbus, Ohio.
Cochran Pipe Wrench Co., Chicago, Ill.
Concrete Products Co. of Pittsburgh, Pittsburgh, Pa.
Connery & Co., Inc., Philadelphia, Pa.
Contractors Machinery & Supply Co., Pittsburgh, Pa.
Cummer & Son Co., F. D. Cleveland, Ohio.

Dietzgen Co., Eugene, New York, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.
Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio.
Duquesne Slag Products Co., Pittsburgh, Pa.

Early, Jos. N., New York, N. Y.
Elliott Co., B. K., Pittsburgh, Pa.

Galion Iron Works & Mfg. Co., Galion, Ohio.
Garford Motor Truck Co., Lima, Ohio.
"Good Roads," New York, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Pa.
Gurley, W. & L. E., Troy, N. Y.

Hastings Pavement Co., New York, N. Y.
Heltzel Steel Form & Iron Works, Warren, Ohio.
Hetherington & Berner, Indianapolis, Ind.
Hunt & Co., Robert W., Chicago, Ill.
Hvass & Co., Chas., New York, N. Y.
Hydrated Lime Bureau, Pittsburgh, Pa.

International Harvester Co. of America, Pittsburgh, Pa.

Jaeger Machine Co., Columbus, Ohio.

Keystone Driller Co., Beaver Falls, Pa.
Koehring Machine Co., Milwaukee, Wis.

Locomobile Co. of America, Bridgeport, Conn.

McCarter Asphalt Block Press, New York, N. Y.
McCurdy-May Co., Pittsburgh, Pa.
McNeill Co., Donald, Pittsburgh, Pa.
Mathews Gravity Carrier Co., Ellwood City, Pa.
"Municipal Journal," New York, N. Y.

National Fireproofing Co., Pittsburgh, Pa.
National Paving Co., Scranton, Pa.
New Jersey, State of.
New York, City of.
Northwestern Steel & Iron Works, Eau Claire, Wis.

Ohio Wood Preserving Co., Pittsburgh, Pa.
Orenstein-Arthur Koppel Co., Koppel, Pa.

Packard Motor Co. of Pittsburgh, Pittsburgh, Pa.
Pennsylvania Dolarway Co., Carnegie, Pa.
Pennsylvania, State of.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Pittsburgh, City of.
Pittsburgh Railways Co., Pittsburgh, Pa.
Pittsburgh Testing Laboratory, Pittsburgh, Pa.
Pittsburgh Wood Preserving Co., Pittsburgh, Pa.

Robeson Process Co., New York, N. Y.
"Rock Products," Chicago, Ill.

Schramm & Son, Chris. D., Philadelphia, Pa.
Scott Co., I. W., Pittsburgh, Pa.
Standard Oil Co. (Indiana), Chicago, Ill.
Standard Oil Co. of New York, New York, N. Y.
Sterling Motor Truck Co., Milwaukee, Wis.

Turbine Sewer Machine Renovating Co., Milwaukee, Wis.

United Gas Improvement Co., Philadelphia, Pa.
U. S. Asphalt Refining Co., New York, N. Y.
U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J.

Wadsworth Stone & Paving Co., Pittsburgh, Pa.
Warren Bros. Co., Boston, Mass.
Warren-Knight Co., Philadelphia, Pa.
Wiard Plow Co., Batavia, N. Y.

NEWS NOTES

The Board of Supervisors of Erie County, N. Y., has approved a report of the good roads committee providing for the construction of 20 miles of new county roads at a cost of $140,000.

The Board of Supervisors of Stanislaus County, Cal., has appointed an advisory committee of four to assist in planning a system of county highways.

Arrangements for Installing an Electric Lighting System along the Meridian Road in Texas for a distance of more than 300 miles, have been completed by D. E. Colp, President of the Meridian Highway Association.

AMERICAN ROAD BUILDERS' ASSOCIATION

150 NASSAU STREET
NEW YORK, N. Y.

President
E. A. STEVENS, Trenton, N. J.

First Vice President
A. W. DEAN, Boston, Mass.

Second Vice President
A. B. FLETCHER, Sacramento, Cal.

Third Vice President
WM. H. CONNELL, Philadelphia, Pa.

Secretary
E. L. POWERS, New York, N. Y.

Treasurer
W. W. CROSBY, Baltimore, Md.

Through the courtesy of the publisher of "Good Roads," this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

The Pittsburgh Convention

The Thirteenth Annual Convention of the Association was held at Pittsburgh, Pa., on Tuesday, Wednesday, Thursday and Friday of this week. Like all of its predecessors, the meeting was a success from every point of view.

A report of the convention, including the technical sessions, the A. R. B. A. banquet and other features, is printed elsewhere in this issue.

That the convention was so successful is a matter of gratification to all members of the Association, especially in view of the unusual circumstances under which the meeting was held. Official statements relative to the opposition encountered in planning for this year's meeting have been printed from time to time on this page, and in "Good Roads" for February 19 was printed a statement by the Association reviewing the controversy concerning the action of the Association in fixing the date for its convention. Members desiring a review of the entire matter are referred to that issue.

A. R. B. A. Members on the Program of the University of Michigan Short Course in Highway Engineering

Several A. R. B. A. members had prominent places on the program of the short course in highway engineering given at the University of Michigan at Ann Arbor, on February 21, 22, 23, 24 and 25.

F. F. Rogers, State Highway Commissioner of Michigan, presented two papers as follows: "The Status of Road Building in Michigan," and "Road Maintenance." He also had charge of one session, devoted to the presentation of reports by highway commissioners and short talks on their experiences. Professor Arthur H. Blanchard of Columbia presented two papers, one an illustrated lecture on "The Construction and Maintenance of Bituminous Surfaces and Bituminous Pavements," and the other "The Economic Design of Highways with Reference to Traffic."

Other papers presented by members were as follows: "Gravel Roads," L. H. Neilsen, District Engineer, Michigan State Highway Department; "Surface Treatment of Water Bound Macadam Roads," Will J. Cleary, County Road Engineer of Berrien County, Michigan; "Some Sand-Clay Roads in Dickinson County," G. V. Carpenter, County Road Engineer of Dickinson County, Michigan; "The Maintenance of Earth Roads," W. S. Gearhart, State Highway Engineer of Kansas, and "The Experience of Maine with Various Types of Road Surfaces Under Various Kinds and Intensities of Traffic," Paul D. Sargent, Chief Engineer, Maine State Highway Commission.

Past President McLean Made Deputy Minister of Highways of Ontario

As was noted in "Good Roads" for February 12, Past President W. A. McLean, who was formerly Chief Engineer of Highways of the Ontario Department of Public Works, has been appointed Deputy Minister of Highways of the Province of Ontario.

As Chief Engineer of Highways of the Ontario Department of Public Works, Mr. McLean was in active charge of highway work in Ontario. He has been a prominent member of the A. R. B. A. for some years and served one year as president of the organization.

New Officers of the A. R. B. A.

As the Annual Meeting of the Association was held on February 4—the day previous to the publication of the last A. R. B. A. Page—no account of the meeting could be printed at that time. A full account of the meeting was printed in "Good Roads" for February 12, in which the address by Col. E. A. Stevens, the newly elected president, was published in full.

The election of officers resulted as follows: President, Col. E. A. Stevens, Commissioner of Public Roads of New Jersey; First Vice President, Arthur W. Dean, Chief Engineer, Massachusetts Highway Commission; Second Vice President, Austin B. Fletcher, State Highway Engineer of California; Third Vice President, Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Secretary, E. L. Powers, Editor, "Good Roads;" Treasurer, W. W. Crosby, Consulting Engineer, Baltimore, Md. Directors for three years: Wm. D. Uhler, Chief Engineer, Pennsylvania State Highway Department; R. A. Meeker, State Highway Engineer of New Jersey; Charles W. Gates, Governor of Vermont; R. Keith Compton, Chairman and Consulting Engineer, Paving Commission, Baltimore, Md.; James H. MacDonald, ex-State Highway Commissioner of Connecticut; Frank M. Williams, State Engineer and Surveyor of New York.

A. R. B. A. Notes

Professor G. E. Martin of Purdue University was one of the lecturers at the road school at Purdue in January.

J. B. Marcellus, of the Portland Cement Association, lectured on "Concrete Road Construction and Maintenance" at the conference on highway engineering held at the Kansas State Agricultural College, February 28-March 4.

A review of the annual report of State Commissioner of Public Roads E. A. Stevens of New Jersey was printed in "Good Roads" for February 26.

P. P. Sharples, Manager of the General Tarvia Department of the Barrett Co., was one of the lecturers at the road school at Purdue University held on January 24, 25 and 26,

C. B. Scott, Assistant State Highway Commissioner of Virginia, was elected Secretary-Treasurer of the Virginia Road Builders' Association at the annual meeting held at Richmond, Va., late in January.

J. D. Groves, Assistant Engineer, Board of Water Supply, New York, N. Y., was one of the authors of a paper entitled "The New Roads Around Ashokan Reservoir," presented at a meeting of the Municipal Engineers of the City of New York on February 23.

W. S. Gearhart, State Highway Engineer of Kansas, lectured on "Road Maintenance," "Sand-Clay, Oiled Sand and Oiled Earth Roads," "Bridge Letting, Construction and Inspection," and "Financing the Construction of Surfaced Roads" at the conference on highway engineering held at Manhattan, Kan., under the direction of the Civil and Highway Engineering Department and the College Extension Division of the Kansas State Agricultural College, February 28-March 4.

COMING MEETINGS

March 6-10—Dominion Good Roads Association.—Third Canadian and International Good Roads Congress, Sohmer Park, Montreal, P. Q. Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Bldg., Montreal P. Q., Canada.

March 9—Vermont Society of Engineers—Annual meeting, Hotel Vermont, Burlington, Vt. Secretary, George A. Reed, Montpelier, Vt.

March 23-24—Florida State Good Roads Association—Convention, St. Augustine, Fla. Secretary, J. P. Clarkson, Jacksonville, Fla.

REPORTS

ESSEX COUNTY, NEW JERSEY: Annual Report of the County Engineer for the Year Ending May 12, 1915. Paper; 6x9 ins., 39 pp.; illustrated; inset map.

The contents of this report include detailed data on various specific street improvements, tables showing work done and costs, a section on bridges and a description of various roads in Essex County. There are several illustrations in the report, most of them being full-page half tones showing improved streets and roads in the county. There is also an inset map showing the county road system.

KANSAS CITY, MO., BOARD OF PARK COMMISSIONERS: Annual Report for the Year Ending April 19, 1915. Paper; 6x9 ins., 163 pp.; illustrated; insets.

In this are included the report to the Mayor by the Board of Park Commissioners and the reports to the board of the Landscape Architect, the Engineer, the Assistant Executive Officer and the Secretary, the latter consisting of tabular financial statements. Road work is given considerable attention in various parts of the report, especially in the report of the Assistant Executive Officer, in which there is a section of about twelve pages headed "Construction and Maintenance of Kansas City Boulevard Pavements." The report is printed on heavy white paper of excellent quality and illustrated by many half-tone views of scenes in the park system. One of these is a large inset and many of the others are full-page cuts. There are three maps printed as insets, one showing various steps in the development of the Kansas City park system and one showing the park and boulevard system of Greater Kansas City in 1914. The other is a large street map of the city showing streets, boulevards, parkways, railroads and parks.

NEWARK, N. J., "COMPREHENSIVE PLAN OF NEWARK": Report of the City Plan Commission, submitted to the Mayor and Common Council under date of December 31, 1915. Paper; 6x9 ins., 180 pp.; illustrated; insets.

This report is divided into four parts as follows: Part 1—Streets; Transportation, Markets; Part 2—Parks; Recreation; Grouping of Public Buildings; Appearance of City Streets and Public Places; Yard and Lot Cultivation; Part 3—Housing; Public Control of the Development of Private Property; Land Subdivisions; Metropolitan Planning; Part 4—Excess Condemnation; Municipal Exhibition; Future Work; Chronological and Financial Program. There is also an appendix which includes the city plan commission law, a list of reports by the City Plan Commission and a list of books and magazines dealing with city planning. The subject of streets is given atention not only in the section of Part 1 dealing exclusively with streets, but also in various other parts of the report. The report is well printed and profusely illustrated by half-tone reproductions of views in Newark and with plans and drawings showing proposed developments. There are also several insets on which are printed maps and plans illustrating present conditions or recommendations for improvements.

PERSONAL NOTES

O. E. Weller has resigned as Chairman of the Maryland State Roads Commission.

C. E. Wright has been appointed County Engineer of Carrol County, Ia., in charge of road and bridge construction.

Harry K. Miller has resigned as Assistant Engineer in charge of a new survey of streets and boundaries of Montclair, N. J.

Joseph Bayne, Assistant City Engineer of Cleveland, O., for more than 30 years, has resigned to take charge of the paving work of the Cleveland Railways Co.

M. W. Parrish, who has been connected with the State School at Tontsawa, Okla., has resigned to take a position with the Illinois State Highway Department.

F. R. Williams has been appointed Assistant City Engineer of Cleveland, O., in charge of paving, succeeding Joseph Bayne, notice of whose resignation appears elsewhere in this column.

C. P. Ballinger, who was City Engineer of Greenville, S. C., has been appointed Consulting Engineer of Greenwood, S. C., where municipal improvements involving the expenditure of $225,000 are under way.

W. F. B. Haynsworth, formerly with the Panama Canal force, has been appointed City Engineer of Greenville, S. C., succeeding C. P. Ballinger, whose appointment to another position is noted elsewhere in this column.

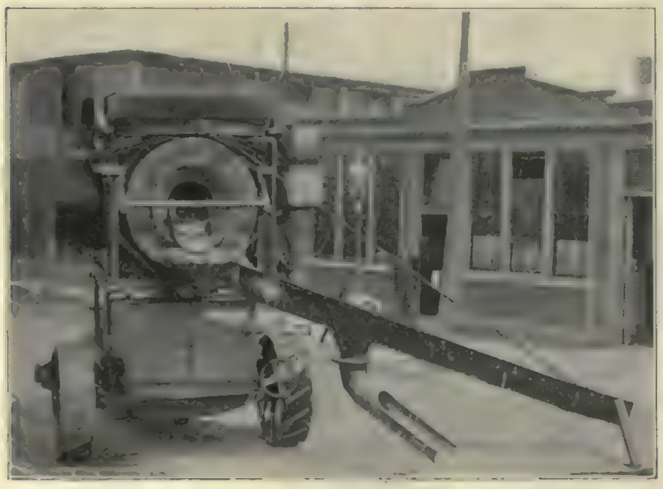
EQUIPMENT — TRADE — MATERIALS

New Street Paver

In the accompanying illustration is shown a street paver of a new type which has recently been put on the market.

The paver, as shown, consists of a concrete mixer, with driving, loading and charging mechanism, mounted on a truck equipped with a traction device. The No. 507 machine has a rated capacity of 7 cu. ft. of mixed concrete per batch, is 10 ft. long without skip or swivel chute and 7 ft. 6 ins. wide over all. The height of the machine, with water tank, is 10 ft. 6 ins.

The machine is equipped with a large skip and swivel chute, the latter being one of its special features. The chute is 12 ft. long and is pitched at an angle of 20 degrees, this, it is claimed, being such that the concrete will flow no matter how dry the mix. It is equipped with four intermediate openings and an adjustable auxiliary chute so that it is not necessary for the concrete to be dropped to the ground from the intermediate openings. This feature is shown very clearly in the accompanying illustration.



SMITH-CHICAGO PAVER SHOWING SWIVEL CHUTE AND ADJUSTABLE AUXILIARY CHUTE.

Another feature to which the manufacturers call especial attention is the water weighing device. By means of this, each charge of water is accurately weighed and automatically poured into the drum through the feed opening along with the unmixed batch from the skip. The control is such that the water can be started into the drum just ahead of the batch or after the batch, although it is stated that experiments have shown that the first method is better. While the weighing mechanism works automatically, it can be operated by hand when desired.

Besides the No. 507 model, the machine is made in three others—No. 504 being smaller and Nos. 510 and 516 being larger. The three large sizes are driven by either steam or gasoline engines, while No. 504 is supplied with the gasoline engine only.

The No. 507 machine is equipped with a 6-HP. steam engine and 8-HP. boiler or with a 6-8-HP. gasoline engine. The capacity of the water storage tank is 75 gals. and of the water measuring tank 16 gals. Equipped with steam engine and boiler, the machine weighs 11,000 lbs.; with a Fairbanks-Morse gas engine, 10,500 lbs., and with a Novo gas engine, 10,000 lbs.

The machine is known as the H-D Type, Smith-Chicago Paver and is manufactured by the T. L. Smith Co., Milwaukee, Wis.

AUER CONCRETE GUARD RAIL IN POSITION AT CROTON-ON-HUDSON, N. Y.

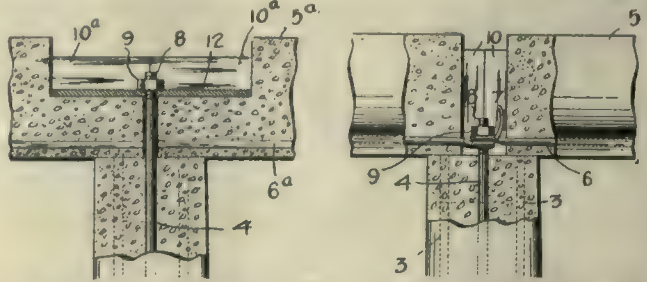
A New Concrete Guard Rail

A view of a new concrete guard rail and two sectional views of the top rail at a post are shown in the accompanying illustrations. The illustration showing the rail in place was made from a photograph of an installation at Croton-on-Hudson, N. Y.

The guard rail consists of reinforced concrete posts and reinforced top and bottom rails. The posts and rails are molded separately, either at a central plant or on the work.

The lower rails are fitted into shallow sockets in the posts, while the upper rails are connected by either of the two methods shown in the drawings. In that at the left the central reinforcing rod of the post extends upward into the comparatively long recess at the junction of the top rails and through a flat metal plate which lies in the recess. The upper portion of the rod is threaded and a nut locks the tie plate down. The joint is completed by filling the recess with concrete.

In the drawing at the right, the joint is made somewhat differently. As in the other case, the central reinforcing rod of the post projects upward into a recess at the adjoining ends of the top rails. In each of these top rails one reinforcing member projects from the end and terminates in an eye which fits over the rod in the post. The joint is completed by screwing down a nut which locks together the three members and by filling the recess with concrete.



SECTIONAL VIEWS OF AUER CONCRETE GUARD RAIL SHOWING METHOD OF CONNECTING TOP RAIL.

It is claimed for the guard rail that it may be easily and economically assembled and may be taken down without injury by taking out the concrete used for filling the recesses and then removing the metal connections.

The fence was invented by George Auer, of White Plains, N. Y., the owner of the patent, and is manufactured by the Auer Concrete Guard Rail Co., Inc., of White Plains.

Asphalt Company Employees to Share in Profits and Get Pensions

The General Asphalt Co., of which the principal subsidiary is the Barber Asphalt Paving Co., Philadelphia, Pa., has announced the adoption of an employees' profit-sharing plan and pension system.

The division of the profits will be on the basis of 1 per cent. of the annual salary of each employee for each $100,000 of net gain to the surplus over and above the amount required for the 5 per cent. dividend on the company's preferred stock. This dividend requires $652,705.

Pensions are to be paid at the rate of 1 per cent. of the average salary during ten years preceding retirement, multiplied by the number of years of service. Thus, in the case of an average salary of $2,000 and 25 years' service, the pension would be $20 multiplied by 25, or $500 a year.

American Coal Products Co. Changes Name

The American Coal Products Co. and the Barrett Manufacturing Co., have announced a decision to unite the good will of both concerns under the name of the Barrett Company. The American Coal Products Co. is known in connection with the sale of sulphate of ammonia and heretofore owned the stock of the Barrett Manufacturing Co.

The latter concern is widely known for the manufacture and sale of coal tar products, but is best known in the road building field in connection with Tarvia and Barrett's Paving Pitch.

The new concern will have the same amount of stock as the American Coal Products Co., and the change in name will be accomplished by exchanging the outstanding certificates share for share.

Blaw Steel Construction Co. Issues New Book

The Blaw Steel Construction Co., Pittsburgh, Pa., has issued a new book which is somewhat more elaborate than the usual trade catalogue and contains a complete description of "Blawforms" for sidewalk, curb, curb and gutter and road construction.

Bound in heavy paper, printed in brown duo-tone, the book contains 24 pages and is completely illustrated with half tones showing the various types of forms, together with road and street scenes where the forms are in use. In addition to the illustrations and descriptive matter, there are two pages devoted to prices and a page on which are listed the numerous Blaw publications. The present publications is known as Bulletin No. 69.

Manufacturers of Concrete Mixers Organize

A number of manufacturers of batch concrete mixers have formed the National Association of Mixer Manufacturers for the purpose of securing closer relationship, the interchange of views regarding the industry, the devising of a standard rating for batch mixers and the consideration of other matters of interest to the association.

The membership of the organization includes the following: Chain Belt Co., Milwaukee Concrete Mixer Co., and T. L. Smith Co., Milwaukee, Wis.; Municipal Engineering & Contracting Co., Foote Concrete Machinery Co., and Marsh-Capron Manufacturing Co., Chicago, Ill.; Oshkosh Manufacturing Co., Oshkosh, Wis.; Schaefer Manufacturing Co., Berlin, Wis.; Ransome Concrete Machinery Co., Dunellen, N. J., and Lakewood Engineering Co., Cleveland, O.

The following officers have been elected: President, Arthur Cameron, Municipal Engineering & Contracting Co.; Vice President, William A. Hart, Chain Belt Co.; Secretary, Harold G. Smith, T. L. Smith Co.; Treasurer, F. C. Wilcox, Foote Concrete Machinery Co.; Member Executive Committee, H. M. Capron, Marsh-Capron Manufacturing Co.

TRADE NOTES

The offices of the Mexican Petroleum Corporation, the Huasteca Petroleum Co., the Petroleum Transport Co. and the Caloric Co. have been moved from 52 Broadway, New York, N. Y., to Room 2805, 120 Broadway.

"Pamphlet K" has been issued by the Hydrated Lime Bureau of the National Lime Manufacturers' Association, Pittsburgh, Pa. It contains 20 pages of matter relating to the advantages to be gained from the use of hydrated lime in concrete road building. The pamphlet is entitled "Improving Concrete Roads: The Effect of Hydrated Lime on Permeability, Expansion and Contraction."

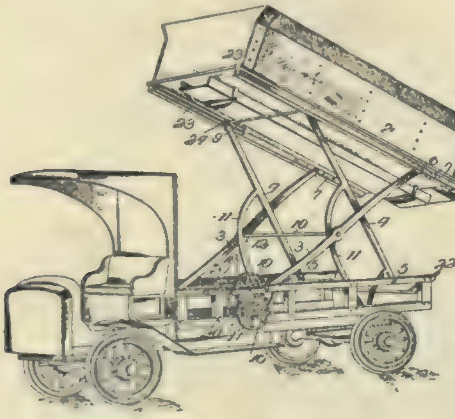
The Austin-Western Road Machinery Co., Chicago, Ill., has issued "The Road Builders' Guide," a booklet of 80 pages and cover, which contains matter descriptive of the company's line of machinery for road building purposes. This includes road machines of various types, road rippers, planers, rock crushers, portable and stationary, bins, screens, road rollers, scarifiers, elevating graders, dump wagons, stone spreading wagons, street sweepers, sprinklers, road oiling machines, dump cars, drags, scrapers and the Austin motor mower. The booklet is profusely illustrated with half-tone reproductions of the various machinery described and contains, as a frontispiece, a picture of the Austin-Western plant.

Kansas Prisoners Working on the Public Roads are to have one day out of every three taken off their sentences for faithful and cheerful work, according to the National Committee on Prison Labor. Road work, it is stated, is to be organized at once, the plan having the support of Warden J. K. Codding, who has recently been reappointed by Governor Capper. The Warden was instrumental in securing the passage of the bill providing the time allowance noted, and states that it is proposed to furnish 25 men and one of the penitentiary officers to superintendent the work and establish the road camps. The municipalities for which the work is done are to pay the state $1.00 per day per prisoner. About one-half of this will be used for feeding and caring for the prisoners and the remainder will be paid to the prisoner or his family.

Eighty-Seven People Were Killed in Highway Accidents in Iowa During 1915, according to the "Service Bulletin" of the Iowa State Highway Commission. In a somewhat lengthy article discussing these fatalities, it is stated that unsafe speeding, accompanied in many cases by various degrees of intoxication, was undoubtedly responsible for more than one-half of the accidents. In a majority of the accidents, according to the reports in the commission's office, the cars "turned turtle." It is noted that, regardless of whether a driver is sober or partially or wholly intoxicated, there is, barring breakage of the machine, usually some road condition partly responsible for such accidents. It is also stated that a study of several hundred clippings covering automobile accidents of all degrees of seriousness indicates that about one accident in fifteen results in a fatality; that one in three causes broken bones or internal injuries, and that for every person killed there seems to be an average of from twenty-five to thirty seriously injured.

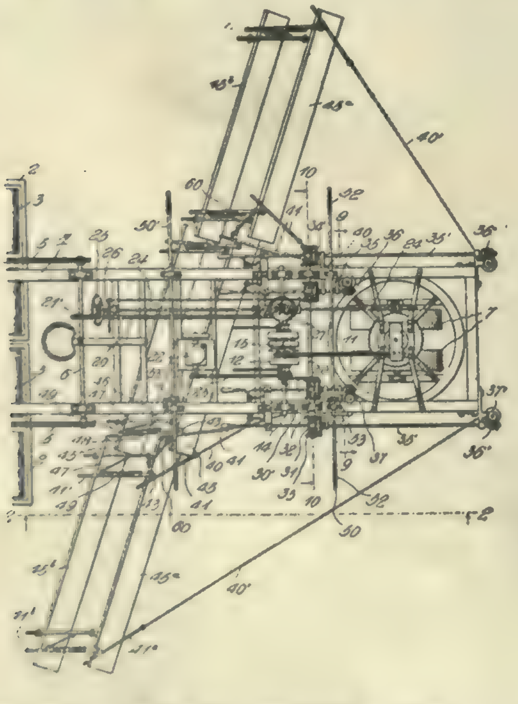
RECENT PATENTS

The following list contains the numbers of the principal patents relating to roads and pavements and to machinery used in their construction or maintenance which have recently been issued, together with the names and addresses of the patentees, dates of filing, serial numbers, etc. In some cases the principal drawing has also been reproduced. Printed copies of patents listed may be obtained for 5 cts. each by application to the Commissioner of Patents, Patent Office, Washington, D. C.:



1,169,903. DUMPING WAGON. Lion L. Woodward, Trenton, N. J., assignor to Fitz Gibbon & Crisp, Trenton, N. J., a corporation of New Jersey. Filed Feb. 20, 1915. Serial No. 9,789. (Cl. 21-86.)

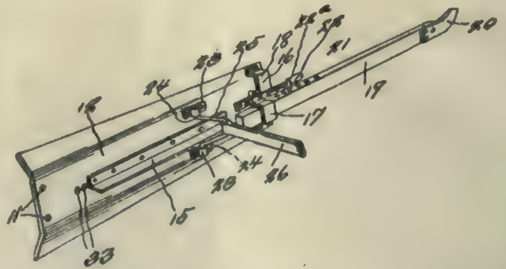
1,169,986. ROTARY GRAVEL SCREEN. Horace Middaugh, Seattle, Wash. Filed Sept. 20, 1915. Serial No. 51,536. (Cl. 83-56.)



1,170,269. ROAD GRADING MACHINE. Elmer A. Hyde, Villisca, Iowa. Filed Feb. 11, 1915. Serial No. 7,519. (Cl. 37-7.)

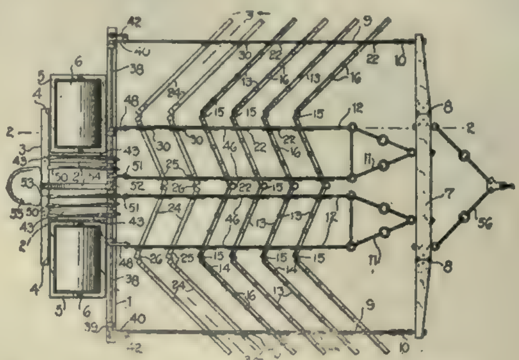
1,170,702. BRIDGE. Joseph B. Strauss, Chicago, Ill. Filed Nov. 4, 1907. Serial No. 400,690. (Cl. 14-42.)

1,170,703. DOUBLE DECK BASCULE BRIDGE. Joseph B. Strauss, Chicago, Ill. Filed Mar. 18, 1908. Serial No. 421,930. (Cl. 14-38.)



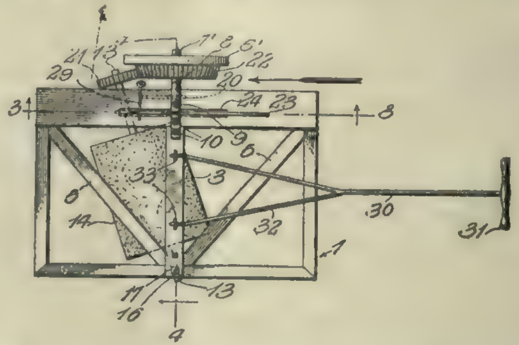
1,170,592. ROAD GRADING MACHINE AND DITCHER. Wm. R. Williams, Owensboro, Ky. Filed Jan. 25, 1915. Serial No. 4,207. (Cl. 37-5.)

1,171,236. ROAD MAKING COMPOSITION. Edward A. Paterson, North Tonawanda, N. Y. Filed June 20, 1914. Serial No. 846,402. (Cl. 106-30.)



1,171,084. ROAD GRADER. Edward E. Barrett, Spokane, Wash. Filed Aug. 12, 1914. Serial No. 856,447. (Cl. 37-5.)

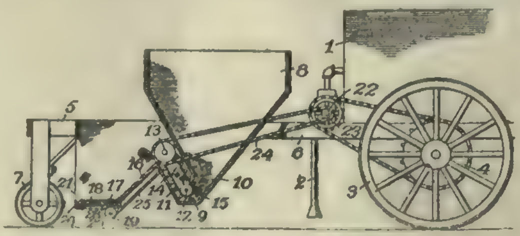
1,170,804. FEED REGULATOR FOR CONCRETE MIXING MACHINES. Wm. J. Dunham, Johnstown, N. Y. Filed May 20, 1914. Serial No. 839,865. (Cl. 83-73.)



1,171,222. PAVEMENT SWEEPER. John B. Martin, Cincinnati, Ohio. Filed Dec. 8, 1914. Serial No. 875,288. (Cl. 15-17.)

1,171,316. COLLAPSIBLE CORE FOR CONCRETE CULVERTS. Arthur E. Camblin, Stella, Nebr. Filed June 4, 1915. Serial No. 32,092. (Cl. 25-131. 6.)

1,171,553. BRIDGE. Joseph B. Strauss, Chicago, Ill. Filed Apr. 1, 1913. Serial No. 758,140. (Cl. 14-38.)



1,172,012. ROAD SANDING MACHINE. John D. Curtis, Worcester, Mass., assignor to Richardson Mfg. Co., Worcester, Mass., a corporation of Massachusetts. Filed Aug. 26, 1912. Serial No. 717,018. (Cl. 94-6.)

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. XLIX
New Series, Vol. XI.

NEW YORK, MARCH 11, 1916

Number 11

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Winona County, Minnesota, Awards Big Highway Contracts

The County of Winona, Minn., has awarded contracts for the construction of 104 miles of state rural highway, which is said to be the largest single letting ever made in Minnesota.

The work is divided into four sections, each let to a separate contractor, the total amount of the bids being $471,000.

Specifications call for a small amount of brick paving, the remainder being gravel and macadam. The work includes the construction of six bridges and a like number of culverts and considerable earth and rock excavation.

H. B. Childs, District Engineer of the Minnesota State Highway Commission at Winona, will have general supervision of the work.

Bids for this work were received in March of last year, but the awarding of the contracts was held up by litigation, the courts having only recently dissolved the injunction against the letting.

Standardization of Streets Planned in Philadelphia, Pennsylvania

The Board of Surveyors of Philadelphia, Pa., acting under authority granted by an ordinance of the Philadelphia Councils, has adopted a plan of standardization of street improvements for all parts of the city, which has been made public by Director George E. Datesman, of the Department of Public Works.

One feature of the plan provides that the improvement of spaces between curb and building lines shall be under control of the municipal authorities and that property owners and builders must obtain lines and locations for all such improvements from the Board of Surveyors.

Standard cross sections for various widths of streets have been adopted, showing in draft plans the location and width for footways, roadways, planting spaces and rows of trees and all future improvements must conform to these plans.

In order to provide for present and future traffic requirements, a scheme has been worked out by which streets may be built on what has been termed an elastic principle. Therefore, instead of constructing the driveway to the full width provided for future necessities, it will be made of sufficient width to care for present traffic requirements and the unused portion on either side will be sodded and located between permanent and temporary curb lines, the latter to be moved back as demanded by the exigencies of traffic. The sidewalks will be permanently located when the street is first built.

On streets varying in width from 50 ft. to 150 ft., based on 25-year periods, it is estimated that, under the new regulations, a saving of from 30 to 50 per cent. will be effected.

Iowa Spent More Than $12,000,000 for Roads and Bridges

According to a report published in the service bulletin issued by the Iowa State Highway Commission, the expenditure for roads and bridges in the state during 1915 amounted to $12,369,024.36, including construction, repairs and maintenance and engineering expenses.

A summary of the report divides the amount expended into the following items: Bridges and culverts, $6,491,110.11; county road work, $3,296,694.36; township road work, $2,581,219.89.

The following table shows the detailed expenditures for road, bridge and culvert construction and repairs and maintenance of roads, the difference between the total shown and the total expenditure noted above being chargeable against state and county engineering expense and the expenses of the State Highway Commission.

ROAD CONSTRUCTION		
County roads, 3,315 miles	$1,365,622.19	
County culverts	942,410.07	
Township roads	298,193.48	
Township culverts	244,473.43	
		$2,850,699.17
REPAIRS AND MANTENANCE		
County roads, repairs	$711,733.00	
County roads, dragging	424,468.17	
Township roads, repairs	829,406.84	
Township roads, dragging	408,757.87	
		2,374,365.88
		$5,225,065.05
BRIDGE EXPENSES		
Permanent bridges and culverts	$4,052,088.43	
Temporary bridges and culverts	1,031,062.96	
Repairs to bridges and culverts	1,179,766.69	
Purchase rights of way, etc.	288,192,03	
		6,551,110.11
Total		$11,776,175.16

Report of the Committee on Resolutions to the Concrete Road Building Conference

The report of the Committee on Resolutions to the Second National Conference on Concrete Road Building, held at Chicago, February 18, contained a number of interesting conclusions, of which the following is an abstract:

In an outline of the conclusions of the conference, the report gives a list of 12 salient features of practice. These are: (1) Drainage of the roadbed is vital; (2) subgrade must be of uniform density and should be compacted; (3) aggregates must be clean, hard and tough; (4) fine aggregates (sand) should be coarse and well graded; (5) a rich mixture must be used; (6) materials must be accurately proportioned; (7) mixing must be most thorough; (8) sloppy concrete must not be used; (9) in general, the use of reinforcement is justifiable; (10) inspection must be intelligent and thorough; (11) concrete must be protected from rapid drying; (12) pavements must not be opened to traffic too soon.

The following principles were adopted as representing good practice in the construction of concrete roads and pavements:

Materials.—Portland cement shall meet the requirements of the standard specifications of the American Society for Testing Materials, and tests should be made in accordance with the methods outlined by the American Society of Civil Engineers.

Aggregates.—Samples of materials should be submitted to the engineer for approval before orders are placed, and, if possible, laboratory tests should be made. If this is impracticable, field tests should be made. The different aggregates should be kept clean and separate. Aggregates to be used in the wearing course of two-course pavements should be placed on planks or some other means provided to keep them free from dirt.

Water.—A large supply of water is necessary for (a) sprinkling the subgrade (b) mixing the concrete and (c) keeping the concrete moist during early stages of hardening. For this latter purpose 25 to 30 gals. per sq. yd. of pavement will be required during the summer months. Insufficient sprinkling is detrimental to the wearing qualities of the pavement.

Reinforcement.—The use of reinforcement is increasing. A coating of light rust will not be detrimental, but excessive rust, paint or other coatings interfere with proper bond. Reinforcement should be kept free from dirt and should be subjected to occasional tensile and bending tests.

Joint Filler.—Joint filler should preferably be of single thickness. Transverse joint filler should be cut to the crown of the pavement by the manufacturer when metal plates are used. A type of joint filler which will iron out readily under traffic is preferable for use in unprotected joints. A joint filler which will not bend easily when concrete is deposited against it is to be preferred.

Joint Protection Plates.—Metal joint protection plates should be properly bundled and wired by the manufacturer. Plates up to 20 ft. should be shipped in single lengths. The exact length should be provided so that the contractor would not have to cut plates. In cutting plates for length, spacing between eccentrics on the installation bar should be considered to avoid interference with anchorage lugs on plates. The manufacturer should use particular care in crowning the bar to avoid the necessity for duplication of work by the contractor.

Drainage.—For roads, proper drainage may be secured through lateral ditches. For streets, as well as roads, tile drains may be used. They should be laid on each side of the roadway or on one side only, with cross drains leading thereto. Drainage trenches, if placed under the subgrade, should be completed before the final rolling.

Grading.—In general, fills should be made in thin layers, the depth depending upon the character of the material used. The fill should be allowed to stand for as long a time as possible, giving it an opportunity to settle before the pavement is placed on it. Deep fills should be allowed to settle through one winter whenever possible. Puddling will be found advantageous in compacting deep fills. Wetting and rolling should be performed when making a fill, in order to secure thorough compaction. Fills should never be made with frozen materials nor with lumps greater than 6 ins. in their greatest dimension.

Subgrade.—The fundamental requirement of the subgrade is that it should be of uniform density so that it will not settle unevenly and cause cracks in the surface of the pavement. When the pavement is constructed on virgin soil, care should be taken to remove all soft spots. If laid on an old roadbed, even more care should be taken, as the subgrade is likely to be more compact in the center than at the sides. An old roadbed should be scarified, reshaped and rolled. The subgrade adjacent to curbs should be hand-tamped.

Forms.—Metal forms are preferred. When wooden forms are used they should be of at least 2-in. stock, capped with 2-in. angle iron, so constructed that sections can be lapped. Particular care should be taken to see that top edges of forms are clean, so as to avoid unevenness in the finished pavement.

Pavement Section: Thickness.—In view of the increasing use of the heavy motor truck and bus, it seems unwise to build pavements less than 6 ins. thick at any point. In general, pavements should be thicker at the center than at the sides. Alleys with an inverted crown and narrow, one-slope roads should have a uniform thickness. Wherever increased thickness can be secured without excessive cost to secure a flat or nearly flat subgrade, such increase is advisable.

Width.—The desirable width for a single-track road is 10 ft.; for double-track road, 18 ft. The total width should be not less than 20 ft. for single and 26 ft. for double-track roads.

Crown.—The crown of roads and pavements should be not less than 1/100th nor more than 1/50th of the total width. Except in unusual cases, 1/100th is sufficient for country roads and 1/50th will be considered satisfactory for alley pavements. For city streets an average crown of 1/75th will generally be found sufficient and should not be reduced except on grades.

Joints.—Transverse joints should be placed across the pavement perpendicular to the center line, about 50 ft. apart. There seems to be a tendency to widen the distance between joints. Joints should extend entirely through the pavement as well as through the curb if integral curbs are used.

Longitudinal joint filler should be staked or otherwise securely held against the curb. Joint material should be placed around manholes, catch basins, etc.

The tendency of present practice is toward the omission of metal protection plates for joints. Plates are more essential in street pavements than in country highways. Plates for protected joints should be wired together with the joint filler and securely held in the installing bars, even when short sections of joint filler are used. Supports should be used when the pavement is of such width that the installing bar deflects. On wide streets every joint should be checked as to crown with sighting T's. When necessary to have plates in two sections, the contractor should arrange to have the manufacturer drill the abutting ends so that the plates may be wired or strapped together. As the plates do not fit tight to the installing bar, a ¼-in. shim is placed under each end of the installing bar to insure that the plates are not covered with concrete.

Mixing and Placing Concrete: Measuring.—It is recommended that a sack of Portland cement, containing 94 lbs. net, be considered the equivalent of 1 cu. ft. The method of measuring materials, including water, should insure accurate proportions at all times.

Proportioning.—The proportions should not exceed five parts of coarse aggregate, measured separately, to one part of Portland cement. The fine aggregate should not exceed 40 per cent. of the mixture of fine and coarse aggregates.

Aggregates.—Bank-run material shall not be used. Proportioning based on sieve analysis or by relative density tests is not practical for concrete roads except where laboratory direction is available. Where proper facilities are available, the above proportions should be varied as the tests warrant.

Mixing.—The ingredients should be mixed in a batch mixer of approved style and the size of the batch should not exceed the rated capacity of the mixer. The mixing should be continued for at least one minute after all the materials are in the mixer and before any of the concrete is discharged. The speed of the mixer should not be less than ten revolutions per minute. The time and not the number of revolutions should be the gauge of proper mixing.

Consistency.—The practice is to mix concrete entirely too wet. The consistency should be such as not to require tamping, but not so wet as to cause the separation of the mortar from the aggregate in handling and placing.

Placing.—If the subgrade has been disturbed by teaming or other causes, it should be brought to its former surface and thoroughly saturated with water. The concrete should be deposited rapidly to the required width and depth. The section should be completed to a transverse joint without the use of intermediate forms or bulkheads, or a transverse joint may be placed at the point of stopping. If the mixer breaks down, the concrete should be mixed by hand to complete the section. Where reinforcement is used, it should be embedded in the concrete before it has begun to set. The concrete above the reinforcement should be placed within 20 minutes after placing the concrete below. In two-course pavements, the top should be placed within 20 minutes after placing the bottom.

Finishing.—The surface should be struck off by means of a template moved with a combined longitudinal and transverse motion. The excess material accumulated in front of the template should be uniformly distributed over the surface of the pavement, except near the transverse joint, where the excess material should be removed. The concrete adjoining the transverse joint should be dense and any depressions in the surface should be filled with concrete of the same composition as the body of the work. After being brought to the established grade with the template, the concrete should be finished from a suitable bridge, with a wood float to true surface. A metal float should not be used. Brooming of the surface is not necessary and grooves are objectionable, even on grades.

Retempering.—Retempering of mortar or concrete that has partially hardened, that is, mixing with additional materials or water, is strongly condemned.

Protection and Curbing.—Too rapid drying out, early exposure to low temperature or opening to traffic at too early a period may seriously damage the best concrete. Hot sun and drying winds are most liable to dry out concrete too rapidly, causing shrinkage cracks or a surface which will not wear well under traffic. The use of a canvas covering will be found effective in preventing this. Sprinkling should not be omitted during the day in case the surface shows a tendency to dry out. Where there is danger of freezing, sprinkling should be omitted and a covering of canvas or straw and canvas should be used. Placing concrete roads in temperatures at or near the freezing point is not advisable. Where such practice is unavoidable the water and aggregates should be heated and fresh work protected from freezing for at least ten days. Chemicals should not be used to lower the freezing point of the mixture. Concrete should not be deposited on a frozen subgrade.

Opening to Traffic.—Under most favorable conditions a concrete pavement should not be opened to traffic in less than two weeks. When conditions warrant, the interval should be at least four weeks.

One-Course Pavement.—Where the materials most readily available are such as to give good construction in one-course pavement, such construction is recommended.

Integral Curb.—The integral curb is recommended in preference to straight curb or combined curb and gutter. Precaution should be taken that the curb is thoroughly bonded to the pavement proper.

Specifications.—The standard specifications for pavements and roadways of the American Concrete Institute are recommended.

COMING MEETINGS

March 16-17—Texas Good Roads Association—Annual meeting, Taylor, Tex. Secretary, D. E. Colp, San Antonio, Tex.

March 23-24—Florida State Good Roads Association—Convention, St. Augustine, Fla. Secretary, J. P. Clarkson, Jacksonville, Fla.

Texas Good Roads Association

The annual meeting of the Texas Good Roads Association will be held at Taylor, Tex., March 16-17, as noted above, instead of about April 1, as was at first intended.

Among the matters to be discussed are the federal aid bill and the state highway bill, which is to be brought up at the next session of the Legislature.

The present officers of the association are John W. Warren, San Antonio, President; W. G. Turner, Fort Worth, Vice President, and D. E. Colp, San Antonio, Secretary.

A state-wide good roads meeting will be held at Bangor, Me., March 16. Plans for the meeting are being completed by the Good Roads Committee of the Portland, Me., Chamber of Commerce and the Bangor Chamber of Commerce. Governor Oakley C. Curtis and the members of the Maine State Highway Commission are expected to be present.

The Four States Highway Association will meet at Texarkana, Tex., March 23. The list of speakers includes E. L. Meredith, President, Jefferson Highway Association, Des Moines, Ia.; L. R. Putnam, Fayetteville, Ark.; L. E. Thomas, President, Board of Trade, Shreveport, La.; State Senator Malang, Joplin, Mo., and J. H. Crutnis, Talihina, Okla.

MEETINGS

Canadian and International Good Roads Congress

The third Canadian and International Good Roads Congress was held at Sohmer Park, Montreal, P. Q., this week, commencing March 6 and closing March 10. There was a very satisfactory attendance when the proceedings were opened by Hon. P. E. LeBlanc, Lieutenant Governor of the Province of Quebec. Among those present were representatives of the Dominon and provincial governments, all of the large cities of Canada, New York, N. Y.; Philadelphia, Pa.; Baltimore, Md., and Boston, Mass. There were also delegates from commercial organizations and motor clubs.

The program for the first day included addresses by Sir Lomer Gouin, Premier of Quebec; J. A. Tessier, Provincial Minister of Roads; J. E. Caron, Minister of Agriculture; Mayor Martin, of Quebec; U. H. Dandurand, Honorary President, Dominion Good Roads Association; J. A. Sanderson, Honorary President, Ontario Good Roads Association, and W. A. McLean, Deputy Minister of Highways of the Province of Ontario. In the evening an informal reception was held at the Place Vigier Hotel.

On Tuesday, the program included the following papers: "Macadam Road Maintenance," W. Huber, Assistant Engineer, Ontario Highways Department; "Gravel and Stone Roads," Gabriel Henry, Chief Engineer of Highways, Quebec; "A Tour of European Roads," illustrated, W. A. McLean; "The Hot-Mix Method of Bituminous Construction," P. Smith, Consulting Engineer, New York, N. Y.; "The Handling and Care of Road Machinery," E. Farfard, Superintendent of Plants, Quebec; "Materials and Methods for Maintenance of Macadam Roads," W. H. Connell, Chief, Bureau of Highways, Philadelphia, Pa.; "The Cost of Maintaining New York State's Highways," F. W. Sarr, Deputy Commissioner of Highways, Albany, N. Y.

The third day's program included the following papers: "Provincial Aid for Road Building," W. J. Levesque, Laval County, P. Q.; "The Legislative Aspect of Road Construction," A. C. Emmett, Winnipeg, Man.; "Brick Pavements," J. Duchastel de Montrouge, City Engineer, Outremont, P. Q.; "The Value of Good Roads to Cities and Towns," Mayor T. L. Church, Toronto, Ont., and "Highway Bridges," George Hogarth, Chief Engineer, Ontario Highways Department.

The papers scheduled for Thursday included the following: "Road Drainage and Foundation," Major W. W. Crosby, Baltimore, Md.; "Concrete Highways and Streets," Percy H. Wilson, Consulting Engineer, Philadelphia, Pa.; "Creosoted Wood Block Pavements," Andrew F. MacCallum, City Engineer, Hamilton, Ont.; "The Selection of Pavements as Governed by the Volume and Class of Traffic," Col. William D. Sohier, Chairman, Massachusetts Highway Commission, and "Penetration Methods with Refined Tars," A. W. Dean, Chief Engineer, Massachusetts Highway Commission.

The morning session on Friday was devoted to an address by Dr. E. M. Desaulniers, Chambly County, P. Q., on "Legislation on Roads in Canada Before and After Confederation," and an illustrated lecture on "Recent Developments in the Construction of Bituminous Macadam and Bituminous Concrete Pavements," by Prof. Arthur H. Blanchard, Columbia University, New York, N. Y. The afternoon session was devoted to the annual meeting of the Dominion Good Roads Association, the chief business being the election of officers, a report of which will appear in a later issue of "Good Roads."

Conference on Snow Removal

A conference on snow removal was held on the evening of March 8 at the Automobile Club of America, New York, N. Y., under the auspices of the Division of Municipal Engineers, George W. Tillson, Chairman; Division of Highway Engineers, Arthur H. Blanchard, Chairman, of the National Highways Association; Society of Street Cleaning and Refuse Disposal of the United States and Canada, John T. Fetherston, President; Automobile Club of America, Elmer Thompson, Secretary; Citizens' Street Traffic Committee of Greater New York, Robert Grier Cooke, Chairman, and the Graduate Course in Highway Engineering of Columbia University.

Over 200 persons attended the conference which was presided over by George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.

The program included the following papers, each of which was afterward the subject of discussion by those present: "Modern Methods of Snow Removal," William H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; "Organization and Control of Large Emergency Labor Forces for Snow Removal," John T. Fetherston, Commissioner of Street Cleaning, New York, N. Y.; "Merchants' Cooperation in Snow Removal," George H. Pride, Treasurer, Motor Truck Club, New York, N. Y.; "Snow Removal Methods Used in Municipalities of the Middle West," Gus H. Hanna, First Vice President, Society of Street Cleaning and Refuse Disposal of the United States and Canada, Cleveland, O., and "The Use of Sewers for Snow Removal," A. E. Kalbach, Deputy Street Cleaning Commissioner, Borough of the Bronx, New York, N. Y.

Paul E. Mercier, Chief Engineer and City Surveyor, Montreal, P. Q., was scheduled to read a paper on "Snow Removal Methods Used in Montreal," but was unable to be present, owing to the Canadian and International Good Roads Congress, which was held in Montreal this week.

Vermont Society of Engineers

The fourth annual meeting of the Vermont Society of Engineers was held March 9 in the roof garden of the Hotel Vermont, Burlington, Vt.

The morning session was taken up by the business meeting, including reports of officers and standing committees. The program for the afternoon session included the following papers:

"The Manufacture of Hydrated Lime in Vermont," G. Z. Thompson, Assistant Superintendent, Vermont Marble Co.; "The Waterproofing of Concrete," T. W. Dix, Professor of Civil Engineering, University of Vermont, and "Causes of Failure in Concrete Work," F. O. Sinclair, City Engineer, Burlington, Vt.

The annual dinner of the society was held in the evening, after which A. C. Grover, City Engineer, Rutland, Vt., President of the society, made an address and a paper entitled "The Engineer's Opinion on Public Questions" was read by Charles W. Baker, Editor of "Engineering News."

Manitoba Good Roads Association

At a meeting of the Manitoba Good Roads Association held at Winnipeg, Man., February 24, a resolution was adopted providing for the petitioning of the Dominion government to admit into Canada, free of duty, asphaltum oils or any other oils suitable for road building. The matter was also brought to the attention of the Canadian and International Good Roads Congress at Montreal, P. Q., on March 6.

A committee consisting of Mayor Waugh of Winnipeg; S. R. Henderson, President of the association; A. C. Emmett and Reeve Haddow was appointed to confer with the Provincial Minister of Public Works regarding a definite line of action on the question of split log drag competitions.

A Paving Campaign involving the expenditure of $165,000 has been planned in Topeka, Kan.

Richland County, S. C., will hold an election April 11 on the question of issuing bonds to the amount of $1,000,000 for road construction.

The Supreme Court of Tennessee has upheld the constitutionality of the act of 1913 authorizing counties to issue bonds to an amount equalling 15 per cent. of the taxable value, for highway construction. Under this act only a majority vote of the County Court is required, obviating the necessity of submitting such questions to a vote of the people.

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Mississippi Legislature Against State Highway Commission

The House of Representatives of the Mississippi Legisla- has voted against a bill providing for the creation of a state highway commission.

According to reports, the legislators were opposed to the provision for the appointment of a highway engineer at a salary of $2,500 a year. This was the only salaried official mentioned in the proposed act.

New York State Completed 1,083 Miles of Roads During 1915

In a report to the New York State Legislature, State Highway Commissioner Edwin Duffey calls attention to the fact that 1,083 miles of actual road construction was completed during 1915. The total designated state and county highway systems in New York include 11,988 miles. Of this mileage there have been completed 7,388 miles leaving 4,600 miles to be finished.

Commissioner Duffey's report states that the total expenditure on New York State highways amounts to $75,000,000. This represents the entire first bond issue and half of the second issue which was approved in 1912. There remains of the second issue an unexpended balance of $25,000,000 with which to complete the highway system.

It is recommended by the commissioner that an appropriation of $10,000,000 be made for construction work during the current year, half of the amount to be available immediately and the remainder on September 1.

The report recommends the submission of a constitutional amendment permitting a state highway through the Adirondack State Forest Preserve. At present there is a provision in the constitution of the state prohibiting the crossing of a forest preserve with a highway, but the commissioner believes that the benefits to be derived from such a project, especially in facilitating the fighting of forest fires, should receive careful consideration.

Commissioner Duffey predicts that the New York-Albany route will be completed by the summer of 1917. Part of this route is over the face of Storm King Mountain, near Peekskill, N. Y., and has been called the greatest highway engineering feat in the world. Its completion will mark the opening of the highway to through traffic from New York City to the state capital.

State of Maine Organizing Patrol for Highway Maintenance

In accordance with the provision made by the last Legislature, the Maine State Highway Commission is at present engaged in the organization of a state patrol for highway maintenance.

The law requires all cities and towns in which there are state or state aid roads to cooperate with the State Highway Commission in the employment of patrolmen who will maintain such mileage of principal thoroughfares as may be agreed upon and will also devote as much time as possible to the maintenance of roads as yet unimproved.

There are at present about 1,300 miles of highways in the state system and the commission is working to have this mileage covered first by the patrol. When the law was passed, it was estimated that at least 500 patrolmen would be needed to cover the state, as noted in "Good Roads" for October 30 last. The size of the force, however, will have to be limited by the funds available for the work, all of which come from the motor vehicle license fees.

Promotions Under Merit System in the Pennsylvania Highway Department

The Pennsylvania State Highway Department has announced a number of promotions in the Engineering Division and the Bureau of Township Highways. The promotions were based on the merit system under which the department is operated by the present administration.

In the Engineering Division, P. M. Tebbs, Assistant Engineer, who has been in charge of District No. 12, with headquarters at Scranton, is promoted to the post of Engineer of Construction, with headquarters at Harrisburg, filling the vacancy caused by the resignation of John T. Gephart, Jr., which was noted in a previous issue of "Good Roads."

W. A. Van Duzer, Assistant Engineer, who has been in charge of District No. 6, with headquarters at York, is transferred to Scranton to succeed Mr. Tebbs.

The vacancy thus created in the York District is filled by the appointment of Charles W. Erisman, who has been a draftsman in the Bureau of Township Highways and who is now appointed Acting Assistant Engineer in charge of District No. 6. All of these promotions are effective at once.

In the Bureau of Township Highways the state has been divided into five districts and promotions have been made of five men who will act as assistant engineers in charge of these districts. The object of this change is to facilitate the work of the Bureau of Township Highways and to bring it and the department into closer touch with the township supervisors and the public. The promotions and formation of districts become effective April 1.

The First District, with headquarters at Harrisburg, comprises the following counties: Dauphin, Lebanon, Schuylkill, Berks, Lancaster, Lehigh, Northampton, Bucks, Montgomery, Chester and Delaware. The engineer in charge of this district is H. A. Thompson, who was formerly attached to the office at Philadelphia.

The Second District, also with headquarters at Harrisburg, comprises the counties of Cambria, Somerset, Blair, Bedford, Huntingdon, Fulton, Franklin, Adams, York, Mifflin, Juniata, Perry and Cumberland. The engineer for this district is George L. Sollenberger, who has been a draftsman in the Bridge Division.

The Third District, with headquarters at Pittsburgh, comprises the following counties: Lawrence, Butler, Armstrong, Indiana, Beaver, Allegheny, Westmoreland, Washington, Greene and Fayette. The engineer in charge of this district is R. B. Hamill, who has been a Chief of Party in the Bureau of Township Highways, at headquarters.

The Fourth District, with headquarters at Warren, comprises the counties of Erie, Crawford, Mercer, Venango, Clarion, Forest, McKean, Elk, Jefferson, Clearfield, Cameron, Potter, Clinton and Centre. The engineer named for this district is W. P. Miller, who has been a draftsman in the Bridge Division.

The Fifth District, with headquarters at Bloomsburg, comprises the following counties: Tioga, Bradford, Susquehanna, Lycoming, Sullivan, Wyoming, Lackawanna, Luzerne, Columbia, Montour, Northumberland, Union, Snyder, Wayne, Pike, Monroe and Carbon. The engineer named for this district is Harry G. Harper, who has been attached to the Harrisburg office.

State of Washington Built 211 Miles of Roads Last Year

An announcement recently made by State Highway Engineer James Allen, of Washington, states that 211 miles of new state roads were constructed and approximately 100 miles of existing roads were repaired and improved during 1915. The cost of the work was $1,222,000.

With the completion of contracts awarded January 24, noted in the issue of "Good Roads" for February 12, the fund for road construction authorized by the last legislature will be exhausted.

Part of this work includes the construction of 14 miles on the Sunset Highway, between Easton and Cle Elum. On this section there will be four concrete bridges, one of them a 100-ft. span over the Yakima River.

Two Highways, Each 200 Miles Long, to be Built in Mississippi

It has been decided to construct two highways extending from Memphis, Tenn., to Jackson, Miss., at a cost of approximately $5,000 a mile. Each of the highway will be about 200 miles in length.

According to present plans, one of the roads will extend through the Mississippi delta, running through the Mississippi counties of DeSoto, Tunica, Coahoma, Tallahatchie, Leflore and Holmes.

The other highway will extend through the eastern hills of Mississippi, touching the counties of DeSoto, Tate, Panola, Tallahatchie, Carroll and Holmes and passing through the cities of Hernando, Senatobia, Sardis, Batesville, Charleston, Carrollton and Lexington.

The supervisors of the counties through which the highways will pass have agreed to raise the funds to finance the undertaking and construction work will be started as soon as possible.

Considerable Paving Work to Be Done in Philadelphia, Pennsylvania

The Philadelphia, Pa., Bureau of Highways has under consideration paving and some repairs to bridges which, according to estimates, will involve the expenditure of approximately $405,500.

In addition to grading, the work includes paving and repaving with asphalt, brick, granite block and wood block, surfacing and resurfacing with water bound macadam, laying curbing and sidewalks and furnishing and applying bituminous materials.

State of Iowa Has More Than $11,000,000 Available for 1916 Road Work

According to a report issued from the office of the Iowa Auditor of State, there will be available for road and bridge work in the state during the current year between $11,117,915 and $11,600,000.

Of this amount it is estimated that property owners will pay $9,617,915 in direct taxes. To this will be added between $1,500,000 and $2,000,000 which, it is estimated, will be received from motor vehicle registration.

The total expenditure for road and bridge construction and maintenance in Iowa during 1915 was $12,369,024.36, as was noted in "Good Roads" for March 11.

Good Results with Convict Labor in Kanawha County, West Virginia

According to a statement by Philip J. Walsh, Superintendent of Road Construction, Kanawha County, W. Va., the county has obtained very satisfactory results from the use of convict labor on road work.

During 1914 and 1915 Mr. Walsh was in charge of a camp of 25 convicts from the state prison. The county paid 75 cents per man per day of nine hours and the state clothed, housed and fed the men, who were worked under the honor system.

The men wore the regulation uniform of the prison and were provided with heavy clothing for winter wear. They were sheltered in tents, but Mr. Walsh recommends portable houses as being more satisfactory.

Kings County, California, To Spend Large Sum for Roads

Expenditures for road and street construction in Kings County, California, during 1916 will reach a total of $968,500 if present plans are carried to conclusion.

Of this amount $93,500 will be expended for the construction of 8.5 miles of state highway lateral. This road is within about a mile of completion and connects with the state highway in Tulare County.

The sum of $675,000 is being spent by the county on the construction of a system of highways of which the first of six units has already been completed. This expenditure is covered by a bond issue, all of which has been disposed of.

In Hanford, the county seat of Kings County, six miles of streets are being paved at a cost of $200,000. The three projects will give Kings County a total of 116.5 miles of paved streets and highways, all of which are to be completed during the present year.

Colorado Counties Raise $1,561,700 for Improvement of Roads

The counties of Colorado have raised a total of $1,561,700 for the improvement of roads and, at a recent meeting, the State Highway Commission apportioned the funds among the various projects which are to receive attention during the current year.

There are approximately 6,000 miles of state highways in Colorado and the sum of $429,636 was allotted for their improvement. One of these is the South Golden Road out of Denver, on which $59,000 will be spent.

The remainder of the funds will be expended by the counties on the improvement of local roads, of which there are 25,000 miles in the state. No allotment was made for the improvement of so-called secondary roads.

Engineers for the Road Work in St. Louis County, Missouri

It has been decided by the authorities of St. Louis County, Mo., that the road and bridge work to be done under the recently voted bond issue of $3,000,000, will be under the general direction of County Engineer William Elbring as Chief Engineer. Other engineers may be appointed to assist Mr. Elbring after the meeting of the County Court on May 1.

It is believed that the County Court will appoint James C. Travila, Consulting Engineer. Mr. Travila was formerly Street Commissioner of the City of St. Louis.

The U. S. Office of Public Roads and Rural Engineering has been asked to furnish a staff of enumerators for the purpose of taking a traffic census of the county.

Ohio Counties to Receive $2,600,000 in State Aid

State Highway Commissioner Clinton Cowen, of Ohio, has announced that approximately $2,600,000 in state aid will be available for distribution to various counties for road building operations during the current year. Of this sum, half will be available about the middle of this month and the remainder in August.

The money will be used for construction and maintenance of main market roads and inter-county roads. In every case, the county receiving state aid must contribute at least a sum equal to the amount received from the state.

A number of the more important counties which received large awards of state aid last year, will not be included in the 1916 distribution.

Road Bonds in Kentucky Counties

Bond issues amounting to $2,350,000 are under consideration in seven Kentucky counties. It is proposed to use the proceeds for the construction of roads.

Marion County is contemplating an election on an issue of $250,000. Hindman County will vote May 18 on a $200,000 issue. Ballard County recently sold $300,000 worth of road bonds. Daviess County will expend the proceeds of a $600,000 issue. An election will be called soon in Henry County to vote on an issue of $300,000. Pike County will vote May 6 on a $500,000 issue, and Letcher County will have an election April 15 on an issue of $200,000.

COMING MEETINGS

March 23-24—Florida State Good Roads Association—Convention, St. Augustine, Fla. Secretary, J. P. Clarkson, Jacksonville, Fla.

May 31-June 2—New York State Conference of Mayors.— Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

MEETINGS

Vermont Society of Engineers

The following officers were elected at the annual meeting of the Vermont Society of Engineers, notice of which appeared in the preceding issue of "Good Roads":

President, H. M. McIntosh, Burlington; Vice President, B. M. Hayward, Montpelier; Secretary, G. A. Reed, Montpelier; Treasurer, A. E. Winslow, Northfield; Director, F. W. Denison, St. Albans.

New Hampshire Good Roads Association

The New Hampshire Good Roads Association was organized at a meeting held February 24 at Nashua, N. H.

Officers for the ensuing year were elected as follows:

President, Ovid F. Winslow, Nashua; First Vice President, Samuel F. Lord, Manchester; Second Vice President, Alfred Clark, Concord; Secretary-Treasurer, George P. Winn, Nashua.

The following Board of Directors was chosen: Maurice N. Layn, Dover; Charles A. French, Laconia; F. M. Everett, Concord, and A. A. Wallace, Keene.

Texas County Officials' Meeting

The semi-annual convention of the County Judges' and Commissioners' Association of Texas was held at Waxahachie, Tex., February 10 and 11. President George N. Denton, Waco, presided.

Several matters relating to road building were discussed, the organization giving particular attention to the matter of legislative aid and the prospective action of the Legislature in reference to the proposed organization of a state highway department.

The entertainment features of the program included an automobile trip to various points of interest, an inspection of the county farm and a banquet.

Springfield, Illinois, Engineers' Club

An open meeting of the Springfield Engineers' Club was held at Springfield, Ill., March 13, at which road building was the principal topic. A feature of the meeting was a question box conducted by Martin W. Watson, Assistant Road Engineer, Illinois State Highway Department.

S. E. Bradt, Secretary, Illinois State Highway Commission, discussed road bond issues and explained the section of the Illinois road and bridge law which authorizes counties to issue bonds for road construction.

W. W. Marr, State Highway Engineer, gave an illustrated address on the proposed system of county roads and H. E. Bilger, Road Engineer, Illinois State Highway Department, read a paper entitled "What Will Be the Condition Twenty Years Hence of Roads Improved Under the Proposed Bond Issue?"

West Tennessee Road Conference

Governor T. C. Rye, of Tennessee, was the principal speaker at the West Tennessee Good Roads Conference which was held February 29 at the Merchants' and Manufacturers' Association, Jackson, Tenn. The governor's address dwelt upon the necessity for good roads in the state.

Among the other speakers and subjects were A. M. Nelson, State Highway Engineer, "Maintenance by Road Patrol;" J. J. Murray, Secretary, State Highway Board, "Board Issues;" Prof. C. E. Ferris, "Maintenance of Gravel and Macadam Roads," and Z. D. Dunlap, Boston, Mass., "Better Materials."

Those leading discussions included Charles B. Ferris of the State Highway Board, A. D. Williams, Chief Road Engineer of West Virginia, and County Commissioners T. B. King of Shelby County, and C. F. Williams of Henry County.

PERSONAL NOTES

Earl A. Zeisloft has been appointed City Engineer of Akron, O.

R. H. Thompson has resigned as Street Commissioner of Ilion, N. Y.

T. L. Higgs has been appointed City Engineer of Parkersburg, W. Va.

Joseph M. Tracey has been appointed City Engineer of Ogden, Utah.

J. L. Hazen has been appointed Superintendent of Streets of Porterville, Cal.

James Adams has been appointed Assistant City Engineer of Binghamton, N. Y.

Charles W. Gossart has been appointed Borough Engineer of Kutztown, Pa.

G. N. Adams, Los Angeles, Cal., has been appointed City Engineer of Tropico, Cal.

R. M. Johnston has been appointed Superintendent of Streets of Gastonia, N. C.

William R. Roy has resigned as State Highway Commissioner of Washington on account of ill health.

E. W. Davis, Zanesville, O., has been appointed Division Engineer of the Ohio State Highway Commission.

Albert Wostenholme, former Superintendent of Streets of Fall River, Mass., has been appointed City Engineer.

Stuart Boyles has been appointed County Surveyor of Harris County, Tex., to fill the unexpired term of the late Austin Miller.

Edward L. Lyons, of the Bureau of Surveys, Philadelphia, Pa., has been appointed Assistant Engineer in the Bureau of Sewage Disposal.

Harold Bargeman, Assistant County Engineer of Maricopa County, Ariz., has been appointed County Engineer vice W. H. Carruthers, resigned.

H. W. Shimer has been appointed First Assistant City Engineer of San Francisco, Cal., to fill the vacancy caused by the death of L. E. Hunt.

T. Ryan, a contractor of Seattle, Wash., who of late years did considerable paving for the City of Seattle, died recently at his home there.

C. R. Ege has resigned as Principal Assistant Engineer to Highway Commissioner W. R. Roy, Olympia, Wash., to take a position with the Portland Cement Association.

Frank B. Manning has been appointed Superintendent of Streets of Fall River, Mass., to succeed Albert Wostenholme, whose appointment as City Engineer is noted elsewhere in this column.

William C. Spiker, a construction engineer with offices at Atlanta, Ga., has been retained to complete the construction of the Market Street Bridge over the Tennessee River at Chattanooga, Tenn. The cost of the bridge will be about $1,000,000.

Thomas G. Bush, Assistant State Highway Commissioner of Washington, has assumed the duties of William R. Roy, whose resignation as State Highway Commissioner is noted elsewhere in this column. In accordance with the Washington highway law, Mr. Bush becomes Acting State Highway Commissioner.

A. N. Johnson, formerly State Highway Engineer of Illinois and now with the Bureau of Municipal Research, New York, N. Y., has tendered his resignation and accepted the position of Consulting Highway Engineer for the Association of American Portland Cement Manufacturers. Mr. Johnson will enter upon his duties on or about April 1 and will have his headquarters at 111 West Washington Street, Chicago, Ill. Besides being State Highway Engineer of Illinois, Mr. Johnson served before that as Third Assistant Engineer of the Massachusetts Highway Commission, State Highway Engineer of Maryland and Chief Engineer of the U. S. Office of Public Roads and Rural Engineering.

NEWS OF THE TRADE

The stock of the Scherzer Rolling Lift Bridge Co., Chicago, Ill., has been purchased by a syndicate of officials of the company, and the business will be continued with practically the same personnel as before the death of Albert H. Scherzer, President of the company.

The Troy Wagon Works Co., Troy, Ohio, has just issued a large folder, printed in two colors, announcing the new Troy reversible wagon. The manufacturers' claim that this wagon has 25 per cent. lighter draft than any train-wagon on the market. The wagon is reversible and is equipped with a special roller bearing. The folder is profusely illustrated with half-tone reproductions of the new wagon in service.

"Research on the Corrosion Resistance of Copper Steel" is the title of a booklet of 24 pages and cover issued by the American Sheet & Tin Plate Co., Pittsburgh, Pa. The booklet is by D. M. Buck, Metallurgical Engineer of the company, and J. O. Handy, Director of the Pittsburgh Testing Laboratories, Pittsburgh, Pa. It contains several statistical tables in addition to the text and is illustrated with half-tone engravings and zinc etchings.

NEWS NOTES

The Authorities of LaSalle Township, Illinois, have rejected all bids for a bridge which will cost, according to estimates, $155,000. New bids will be received March 24.

The Low Bid on the Temporary Belle Isle Bridge at Detroit, Michigan, was $99,999. The amount appropriated for the purpose is $100,000. All other bids received were in excess of this figure.

Governor Brumbaugh and State Highway Commissioner Cunningham of Pennsylvania are expected to speak at a meeting to be held at Harrisburg, Pa., March 21 for the purpose of organizing a William Penn Highway Association, the object of which is to build a highway from Philadelphia to Pittsburgh.

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Notice to discontinue subscription should be sent to the New York office.

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Cleveland, Ohio, and Cuyahoga County to Join in Paving Street

The City of Cleveland, O., and Cuyahoga County will join in paving Euclid Avenue in East Cleveland. Bonds to the amount of $250,000 will be issued to pay for the improvement. The city, county and property owners will each pay one-third of the cost.

It is expected that work will be started about the middle of May and the pavement will be completed by September.

Vermilion County, Illinois, Lets Contracts for 169 Miles of Paving

The Board of Supervisors of Vermilion County, Ill., has awarded contracts for 169 miles of roads of which 141 miles are to be of concrete and 28 miles of brick.

According to the bids received, the work will cost $1,165,952.23. It will be paid for out of a bond issue of $1,500,000 which was approved by the voters of Vermilion County two years ago.

The successful bidders and the amounts of their bids are as follows:

Division 1, Harding & Slattery, Crawfordsville, Ind., $116,444; Division 2, Granite City Lime & Cement Co., Granite City, Ill., $172,393.44; Division 3, A. D. Thompson, Peoria, Ill., $113,053; Division 4, Eclipse Construction Co., Winnetka, Ill., $101,974.19; Division 5, Prendergast & Clark Construction Co., St. Louis, Mo., $124,800; Division 6, M. J. Hanick, St. Louis, Mo., $129,825; Division 7, Granite City Lime & Cement Co., $132,947.60; Division 8, P. M. Johnston & Co., St. Elmo, Ill., $113,200; Division 9, Ewing, Shields & Co., Joliet, Ill., $161,315.

New York State Assembly Passes Bill for County Highway Aid

The New York State Assembly has passed the annual appropriation bill for state aid for town and county highways during the current year. The bill carries the sum of $1,928,000.

The roads on which this appropriation is to be used are purely local in character and do not form part of the New York state highway system.

Several Counties to Hold Elections on Road Bond Issues

Special elections will be held in the following counties for the purpose of voting on proposed bond issues for road construction. The list includes the date of the election and the amount of the proposed bonds:

Jefferson County, Mo., April 12, $500,000; Lawrence County, Tenn., April 15, $350,000; Crittenden County, Ky., May 27, $200,000; Lincoln County, Ky., May 31, $200,000.

Repaving in Brooklyn, New York, Would Cost a Million

The Board of Estimate and Apportionment, New York, N. Y., has been asked by President Lewis H. Pounds of the Borough of Brooklyn to issue corporate stock to the amount of $1,000,000 for the purpose of repaving 86 streets in various parts of Brooklyn during the current year.

Some of the larger items in President Pounds' estimate are: $87,000 for Wallabout Market and adjacent thoroughfares, $35,800 for Utica Avenue, $74,600 for Rogers Avenue, $42,500 for Van Brunt Street, $34,700 for Third Avenue and $38,600 for 79th Street.

State of Georgia Used Many Convicts on Road Work Last Year

A report of the State Highway Committee of the Chamber of Commerce, Atlanta, Ga., states that during the past year 7,276 state and county prisoners were employed on road work.

The labor of these convicts, according to the report, was valued at $2,646,000, which, added to cash expenditures, made a total of $6,342,377 spent on road work last year. An average of about five miles a day was completed.

The committee is using these figures in support of its recommendations for legislation providing for a uniform system of highway construction, in which all county highway officials shall act under the general supervision of a state highway commission and a state highway engineer.

The report continues that inquiries sent to all counties produced 123 replies, and of these only 18 reported even the occasional employment of experienced road builders.

Tests the Determination of the Cementing for Value of Bitumens[*]

By **PHILIP P. SHARPLES**[†]

For a number of years there have been attempts to introduce into the standard tests on bituminous materials used in road construction a test for the cementing or binding value of asphalts and pitches. The subject is fraught with pitfalls of many kinds. All the questions relating to the temperature of testing apply in an added degree to tests for cementing value, but we have in addition the questions of what the bituminous material is to bind together—whether the tests are to be applied to the bitumen alone or to the bitumen as mixed with mineral aggregates and prepared for paving work.

Among the different experimenters little attention seems to have been given to the difference between adhesive and cohesive tests. The cohesive tests are important in all kinds of paving work, but the adhesive tests become equally important in waterproofing work of all kinds, in pavement fillers and expansion joint materials and in paving cements to be used either in cold mix processes or by the penetration method.

In the case of coal tar pitches and native asphalts, the subject is further complicated by the presence of very finely divided non-bituminous materials, called in the one case free carbon, and in the other colloidal clay. These profoundly affect the viscosity and strength of the bitumen in a way that is difficult to eliminate or measure. Investigators have approached the problem from very different angles, and though a number of methods have been brought forward, none, thus far, has been entirely satisfactory. Among those who have experimented are Lester Kirschbraun, Colonel E. E. Crompton, Major W. W. Crosby, A. W. Dow, J. S. Crandell, Prevost Hubbard, J. E. Myers, W. H. Fulweiler, O. Binder, The U. S. Geological Survey (fuel tests), and the French Admiralty.

In a general way the methods used by Col. Crompton and Messrs. Hubbard and Crandell were the same, while those of Kirschbraun, Crosby and others followed other lines of investigation and treatment. These methods were respectively (1) making briquettes of representative mixtures, and then testing them for impact and compression; and (2) pulling apart films or pieces of neat bitumen and measuring the force required to rupture them.

Kirschbraun states that the binding value of a plastic binder is limited to the amount of tension it can sustain over a given distance. Or, it would be the product of mass times distance, or the area enclosed between a curve, plotted to represent tension and distance, and the "X" axis.

He says there must be a certain amount of "give" to a bituminous pavement, and, therefore, the bitumen used must be capable of elongating to some extent in order that sufficient plasticity may be secured. There must be a certain amount of adhesion as well as cohesion, but exception may be taken to the statement of Kirschbraun that cohesion is the more important of the two, and that adhesion enters but little into the discussion. It is lack of adhesiveness that lowers the binding value of many of the asphalts that are used as fillers for block pavements and for use by penetration processes.

It would be well to review the methods that have been used to date, of which anything has been published.

E. W. Parker ("Condition of the Coal Briquetting Industry in the United States," 1906) states that: "Out of the many attempts that have marked the incubating period of briquetting development has grown the knowledge that coal tar pitch, in the Eastern States, must be relied on to supply all or the greater part of the binding material. In the far West the residium produced from the refining of the heavy asphaltic base petroleums is successfully used. The results obtained in St. Louis in the United States Geological Survey fuel testing plant show that either coal tar pitch, or asphalt pitch, are the only really successful binders."

Several tests are in use by makers and consumers of coal briquettes to determine cohesion. In France the briquettes are tested as follows: 110 lbs. of briquettes are divided into 100 pieces of 1.1 lbs each, which are placed in a cylinder, 36 ins. in diameter, and 39 ins. in length. This cylinder revolves at a speed of 25 r. p. m. After being charged it is revolved for two minutes, and the contents are thereupon sifted on a screen perforated with holes 1.12 ins. square. The proportion which does not pass through this screen indicates the degree of cohesive force which, in the case of the French Admiralty tests, should reach 52 per cent.

"Ordinarily briquettes may be considered sufficiently cohesive when the loss occasioned by dust and breakage involved in their use does not exceed 5 per cent."

One test that has been noted for coal briquettes calls for the percentage of breakage and loss to be determined after the briquettes are shoveled from a bin into a car. Another requires that test specimens be taken in the hands and handled, and also be examined by the eye. Mr. O. Binder mixes sand and pitch and compresses the mixture in a cylindrical mold at a given unit pressure. Here again the comparison of results is made by hand and eye, rather than by testing the cylinders for impact, compression, or tension.

The tests made at Norfolk by the U. S. Geological Survey for cohesion were the "drop test" and the "tumbler test." Briefly these were as follows:

Fifty pounds of briquettes were put in a box 24 ins. square and 12 ins. deep, with a drop bottom, 6½ ft. above a cast iron plate in the bottom of a second box. The briquettes were suddenly dropped on the plate, then screened on a 1-in. mesh wire screen. The pieces held on the screen were again dropped, the total number of droppings being five. At the last screening the percentage that the weight of the pieces held bore to the original weight was called the "per cent. held by a 1-in. screen," and the remainder was called the "per cent. through a 1-in. screen." The "tumbler test" was very similar to the French Admiralty test given above. (See Bulletin 385, U. S. Geol. Survey.)

In an article in the "Proceedings of the American Society for Testing Materials," Vol. IX. 1909, Prevost Hubbard gives the results of his experiments on the effect of free carbon in tars from the standpoint of road treatment. Taking four samples of tars of very different consistencies he brought them to the same consistency by mechanically mixing with them free carbon in the shape of lamp black. In one of his experiments he made a number of briquettes of sand and tar cast in a cylindrical mold, using 6 per cent. of tar in some and 10 per cent. of tar in others. These were then tested for compression and the results were tabulated. Since these tests were made for the purpose of determining the effect of free carbon in tars they did not include tests on asphalts. Furthermore, if the free carbon were removed, the samples used would necessarily be of very different consistency, and therefore, what was actually compared were not tars of the same consistency but tars of different consistency brought to the same consistency by the mechanical addition of free carbon.

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[*] Paper presented before Section D of the American Association for the Advancement of Science at the Columbus (Ohio) meeting, Dec. 29, 1915.

[†] Manager, General Tarvia Department, Barrett Mfg. Co.

Col. Crompton has written into his specifications prepared for the Road Board of England what he terms "percussion tests," which are really tests of the binding or cementing value of the wearing course of bituminous pavements. "From the first batch, and from every tenth succeeding batch, according to the magnitude of the work, test cylinders shall be prepared as follows and set aside for testing and record purposes * * * 50 grams of the hot mixture from a batch at the completion of the mixing should be filled into a mold cylinder, 1¼ ins. diameter by 2 ins. deep. A plunger is inserted and driven down by a few blows of a mallet and finally compressed by a screw jack or bench vise. When cold the compressed cylindrical sample is to be forced out and marked for identification. * * * A pressure of 500 lbs. must not shorten the cylinders more than 5 per cent. at 77° F., or 10 per cent at 100° F., and in neither case must cracks show themselves on the external cylindrical surface.

"The cylinders must stand not less than 10 blows delivered by the ball end of a hammer rounded to 1 cm radius, the head of which weighs 2 lbs., falling through a distance of 8 ins. The number of blows will be counted until the first crack appears."

It will be noted in the foregoing that no definite pressure in molding the briquettes is specified, nor is there a temperature to which they shall be brought at the time of breaking. It will always be found that slight variations in the methods of making the tests cause considerable variation in the results, so that it is necessary to take every precaution to duplicate the conditions under which each of the tests is made.

Following along the lines outlined above John S. Crandell in 1913-14-15 made and tested a large number of briquettes. Instead of confining the tests to one material, 18 different bituminous materials were tested. They were mixed separately with varying proportions of sand and stone. The proportion of bitumen increased by degrees from 6 per cent. to 15 per cent. by volume of the entire mass. The briquettes were all made by the same person, under uniform conditions, with uniform care. They were tested for impact in the Page impact machine, at 5°C., after aging a uniform time. All reasonable precautions were taken to insure uniformity throughout. Two briquettes of each mix were made and tested. In spite of the care exercised in heating, molding, cooling and testing, surprisingly erratic results were obtained in some cases, although the general idea gained from a study of the curves made by plotting the percentage of bitumen as abscissae and the number of blows required to fracture the specimens as ordinates showed that the mixture of maximum strength was that which contained about 11 per cent. of bitumen. While a greater amount of bitumen gave a greater number of blows in a number of instances, yet the increase over those containing about 11 per cent. bitumen was so small that the conclusion to be drawn was that the economical limit was at the lower percentage.

Major W. W. Crosby endeavored to work out a satisfactory cohesion test. He used two circular glass disks, each about ¼ in. thick, 66 mm. in diameter, area 3,491 sq. mm., with a groove in the circumferential edge about 3/16 in. deep. Three grams of bitumen were placed on the lower disk, which was then covered with the other. They were then pulled apart horizontally, and the pull was recorded by a spring balance. These results were not wholly satisfactory, and the method was improved by warming the disks and the bitumen between them, and then pressing the disks together until they were thoroughly coated. They were then left over night in a temperature of 25° C. The results were very much better. Some of the asphalts, however, refused to cover the disks and hence did not give as good results as were hoped for. This test would necessarily be successful only when the adhesion exceeded the cohesion. If the cohesion exceeds the adhesion the material pulls away from the disks.

L. Kirschbraun devised an apparatus that records the stress applied over a distance. The form of the briquette adopted was that commonly known as the Dow molds which are used for making ductility tests. A dynamometer recorded the stress, and readings were taken at each 5 mm. elongation. Curves were then plotted with centimeters elongation for abscissae, and kilograms for ordinates. The conclusions reached are interesting. It was found that the cementing value increases with hardness up to a certain limit, at which the material becomes too brittle for service on the streets. Fluxing beyond a certain point reduces the ability to elongate, and also reduces the binding value. It is necessary to consider not only the binding value alone, but also the ability of the binder to elongate, in order to prescribe those which have the property of holding together mineral aggregates without undue tendency to cracking. Pavements under heavy traffic require stronger and more cementitious binders with less need of these binders to elongate. It is claimed that the method described furnishes a means of determining the value of the various fluxes, and their suitability in asphalt combinations.

A test known as the "toughness test" has been used by the New York State Commission of Highways. This test which has been devised by J. E. Myers consists of making cylinders of neat bitumen and testing them for impact. The specimens are brought to 0° C. In making the test the first drop of the hammer is from a height of 5 cm.; and for each succeeding blow the height of the drop is increased 1 cm. The height from which the hammer falls when rupture occurs is given as the toughness of the material.

Clifford Richardson and C. N. Forrest ("Proceedings of the American Society for Testing Materials," Vol. IX, 1909) give the following test for cementing value: "Petroleum oils have very feeble if any cementing value. Materials requiring a high temperature to flow freely will not adhere to cold road metal. To determine these properties, the material under examination is heated to the temperature at which it will be used in practical work, and a portion is then allowed to flow over the surface of a slab of marble or glass, 4 ins. wide, 5 ins. long, and 1 in. thick. After standing 24 hrs. at 77° F., the film upon the slab must be decidedly sticky when tested with the fingers, and must adhere so that it cannot be pulled off." The method at its best is but a crude one.

C. B. Osborne in "Good Roads," June 7, 1913, describes a machine for testing adhesiveness. The machine consists of a free ring rotating around a cylindrical mandrel. The bitumen to be tested is placed between the ring and the mandrel and the time required to rotate the ring is taken. The machine does not, therefore, test adhesiveness but a modified resistance to flow which depends on its value in comparison with other viscosity tests, in that the temperature of testing, 77° F., is the practical working temperature of the material.

The methods that have been employed show wide variety in scientific accuracy. Those that give the most promise are the methods on neat bitumens employed by Kirschbraun and the briquette methods of Crandell. The field for future research would seem to be in combining these two, using perhaps also the method employed by Myers. It is only by the collection of a large amount of data by different methods on the same series of samples that progress can be made.

The problem of the tars is even more difficult. Hubbard has indicated some of the difficulties of the problem and pointed the way for future research. Much however remains to be done in this difficult field. Research in this field would necessarily be accompanied by the devising of means of eliminating the free carbon in the comparisons without otherwise changing the bitumens. Up to the present time this has not been successfully done.

A study of the briquette methods of Crandell would seem to show the necessity of devising better methods of choosing and sizing the mineral aggregate and of compressing the briquettes in order to make them of uniform compression.

The results of devising a successful method cannot help being far-reaching. A direct method would be given for the comparison of different kinds of bitumens in a practical way that would be of great value both to the manufacturer and user of bitumens.

My thanks are due to my colleague John S. Crandell for his valued assistance in preparing this paper.

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COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

MEETINGS

Canadian Good Roads Association

The officers elected at the annual meeting of the Canadian Good Roads Association, an account of which appeared in the March 11 issue of "Good Roads," are as follows:

President, J. Duchastel de Montrouge, Outremont, P. Q.; Vice President, F. L. Squire, Toronto, Ont.; Secretary-Treasurer, George A. McNamee, Toronto, Ont.

It was decided to hold the next meeting of the organization at Winnipeg, Man.

Chautauqua County, New York, Highway Superintendents

The following officers have been elected by the Chautauqua County, N. Y., Association of Highway Superintendents: President, L. A. Bigelow, Portland; Vice President, Archie McKeever, Chautauqua; Secretary-Treasurer, C. J. Thompson, Carroll.

The annual meeting of the association was held at Fredonia, N. Y., March 15, at which papers were read by C. W. Vrooman, Clymer; C. J. Thompson, Carroll; J. D. Brown, Arkwright; A. M. Geiger, Sheridan; J. W. Cockburn, Hanover; I. G. Turner, Pomfret, and H. M. Bailey, Sheridan.

Texas Good Roads Association

The need of a state highway department in Texas was one of the principal topics at the convention of the Texas Good Roads Association, held at Taylor, Tex., March 16 and 17. The association will urge the Legislature to make provision for the establishing of such a department at the coming session.

The President of the association, John W. Warren, San Antonio, presided at the sessions of the convention which was attended by more than 300 delegates from all parts of the state.

Among the speakers were C. N. Avery, D. C. Reed, Lloyd Lockridge and Samuel Sparks, Austin; O. G. Bowman, Hillsboro; J. Lee Rountree, Judge Richard Critz and Mayor John A. Hudson, Georgetown; Mayor J. W. Riggins, Waco; E. R. Cone, Texas Department of Agriculture, and W. W. Watson, Salina, Kan.

Officers for the ensuing year were elected as follows:

President, W. G. Turner, Fort Worth; First Vice President, Howard Bland, Taylor; Vice Presidents, O. C. Payne, Dallas; B. C. Hetties, Waco; G. W. Keeling, Pittsburg; H. D. Matthews, Houston; J. A. Graham, San Antonio; Secretary-Treasurer, D. E. Colp, San Antonio; Assistant Secretary, Thomas L. Beauchamp, Paris.

In addition, there were elected a Board of Directors and a Board of State Councillors. The place for holding the 1917 convention will be decided by the Board of Directors.

Resolutions were adopted urging the next Legislature to establish a state highway department and to enact legislation compelling counties and districts providing funds for road construction by special tax or bond issue to make suitable provision for maintenance. Legislation looking to the discontinuance of the narrow wagon tire was also asked for.

The President of the association was authorized to appoint a committee on legislation to present matters of this character to the proper authorities.

NEWS OF THE TRADE

The Blaw Steel Construction Co., Pittsburgh, Pa., has issued Bulletin No. 70, a folder printed in two colors, describing a new Blaw product known as the Blaw adjustable rectangular culvert form.

The White Company, Cleveland, O., has recently issued a series of three folders describing the White good roads truck and the White combination sprinkler and flusher and liquid asphalt distributer. One of the folders gives a list of 239 states, counties and municipalities owning White trucks. The entire series is illustrated with half-tone reproductions of the apparatus.

Crittenden County, Arkansas, is planning to build 25 miles of roads in District No. 1 at a cost of from $200,000 to $250,000.

Cincinnati, Ohio, Will Have an Election some time in April on the question of issuing bonds to the amount of $2,250,000 for street improvements.

The Highway Commission of Fresno County, Cal., recommends a bond issue of $3,500,000 for the purpose of building 325 miles of highways.

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SNOW REMOVAL IN MANHATTAN BOROUGH, NEW YORK CITY

Since the March 4 number went to press there has been held in New York City a conference on snow removal, and, in addition, the problem of removing snow from the city streets has been brought to the front by several somewhat heavy snowfalls. For these reasons and because the proper time to formulate plans for efficient snow removal seems to us to be during the season in which there are no snowstorms, the present seems an opportune time for comment on the subject.

When the conference previously alluded to was held, New York City was in the midst of a series of snowstorms. Some of the streets had been cleared, some had been partly cleared, and more than a few were in very bad condition. On many of the latter about the only clearing that had been done several days after the last snowstorm was what had been accomplished by rain, the sun and traffic.

Traffic problems in the Borough of Manhattan are unusual and it is fully realized that much of the adverse criticism of the borough's streets has been based upon ignorance of the character of these conditions. The influence of Manhattan's layout and of the kind of traffic the streets have to carry is quite as marked in snow removal as in other street work, and while it is true that methods that will work well in one locality are not always feasible in another place. it seems certain that the New York street cleaning authorities could well adopt some of the ways and means that have been developed in other cities.

In Philadelphia, according to the information at hand, excellent results have been achieved by the use of snow plows, both drawn by horses and attached to motor trucks. Plows have been used in New York to a certain extent, but not, we believe, as much as they might be. Since one of the greatest obstacles to snow removal in New York has been the difficulty of obtaining enough shovelers, the motor truck plow would seem especially well adapted to the city's needs, since one such outfit can do the work of a considerable number of laborers.

A very large reduction in the amount of work necessary to perform immediately after or during a storm could be made by cutting down the area which the department attempted to clean. In Manhattan Borough it is necessary that certain main north and south arteries of traffic be cleared thoroughly and as soon as possible. The same is true of many downtown cross streets and a few of the principal cross streets further uptown. No necessity exists for the removal of snow from the entire widths of the majority of the crosstown streets in the residence districts above, say, 59th Street. Why would it not be entirely feasible to clear only the southerly halves of the odd-numbered streets and the northerly halves of the even-numbered streets and allow only east bound traffic on the former and west bound traffic on the latter? We do not know that this plan has not been tried, but if it has the results have not been made public. If it were put into practice the clearing of one side of the street could be done largely by means of plows, and the slight inconvenience to property owners and tenants on the uncleared side would be more than offset by the greater facility of travel in general. If it were felt that any considerable injury was done to those on the uncleared side, that side might be cleared the next time and the side formerly cleared left untouched.

There might, of course, be some difficulty in enforcing the traffic rules necessary in connection with such a plan, but by giving enough publicity to the experiment this difficulty could be largely obviated. There is certainly need of improvement in the clearing of the city's streets after snows, and nothing that promises better results should be neglected.

INSTRUCTION IN ROAD BUILDING

During the past few years a great deal of attention has been given to instruction in road building. This educational propaganda, as it perhaps can be justly termed, has been carried on in a great variety of ways. The last to come to our notice is the correspondence course recently instituted by the University of Oklahoma, mention of which is made elsewhere in this issue.

The "road school," or so-called short course in highway engineering, has been one of the most favored methods of giving instruction. These institutions are well enough known to readers of "Good Roads" to require no detailed description here. It may be pointed out, however, that they have differed greatly in degree of usefulness. Most of them have been arranged primarily for the local road authorities of various sections of the country and as such have partaken more of the nature of local conventions than of "schools." In addition to these, there have been established a few more thorough courses in road building, of which the most notable example is the postgraduate course at Columbia University. This has been undertaken on a large scale and sufficient time has been devoted to it each year to make it of very real advantage to those in a position to take it. Moreover, the requirements for admission have been such as to admit only those qualified to make the most of the opportunity offered.

The Columbia course, while not in any sense a "road school" as that term is ordinarily used, may, nevertheless, properly be put into the same classification. It probably represents the most efficient of such institutions. At the other end of the scale are attempts such as that made last year in Alabama to pass a law requiring the teaching of "civil engineering and practical and scientific road building" in various educational institutions, including county high schools, normal schools and agricultural schools, by means of a six weeks' course. The utter futility of such a measure as this was pointed out at the time the law was pending. ["Excessive Zeal in Alabama," "Good Roads," June 5, 1915, page 218.] Fortunately the proposed measure never became a law.

There will, of course, never be devised anything better in the way of preparation for building roads and streets than a course in civil engineering in some technical school of recognized standing, followed by actual experience. If such training can be supplemented by a postgraduate course in road building such as that given at Columbia, or by specializing in certain branches of chemistry during or after the undergraduate course in civil engineering, so much the better. The additional scholastic preparation, however, is out of the reach of the ordinary man, who is confronted by the necessity for earning money immediately upon graduation. Moreover it is unfortunately true that the pay the engineer engaged in road work may expect is not sufficient to justify a heavy investment for a highly specialized education.

There are, of course, engaged in the work of building roads far more men who have had no special training than there are who have had such advantages, and for these it is possible to devise courses of study which will better qualify them for the work in which they are engaged. The "short courses" and "road schools" are attempts to solve this problem, and so far are the best that have been developed. They have, however, certain inherent disadvantages which a correspondence course can, perhaps, obviate. On the other hand the correspondence course will always lack the advantages of personal instruction. It would seem that the logical method of offering instruction to the busy road builder would be by a combination of the road school or convention and the correspondence course, and it is probable that some such plan may be worked out in the not far distant future. As a matter of fact the beginnings of such a plan may be seen in the work of those state highway departments which hold meetings of their staffs at intervals and supplement these by bulletins and letters of instruction throughout the year.

It is just as certain that the introduction of highly specialized courses in highway engineering in the undergraduate work of technical schools is not advisable, as it is that the best preparation for road building is an engineering education supplemented by experience in road work. This matter has been fully discussed in these columns and will not be gone into here. Only two facts need to be pointed out. The first is that the time available for undergraduate study is not sufficient to include this special training and also the broad technical education that is necessary for success in any line of engineering. The second is that few engineering students are sufficiently sure of the line of work they will follow to warrant their taking courses any more specialized than the ordinary courses are at present.

NEWS NOTES

Parkersburg, W. Va., Will Pave 20 Streets at an approximate cost of $127,000. Brick and concrete are the materials to be used.

The Highway Commissioners of Edwardsville Township, St. Louis County, Missouri, have decided to build a 1,500-ft. concrete bridge over the Cahokia Creek Bottoms.

The Douglas County, Nebraska, Good Roads Club has elected the following officers: President, H. R. Avery; Secretary, Benjamin Schomer; Treasurer, George Rohwer.

The Police Jury of Jefferson Davis Parish, Louisiana, wants to spend $700,000 for graveling the parish roads. An election will be held soon on the question of issuing bonds.

The City Council of Richmond, Va., has been petitioned to make provision for a steel bridge across the James River, connecting the western half of the city with the Southside.

The Board of Supervisors of Sutter County, Cal., is considering the advisability of raising funds to build several bridges and improve county roads at a cost of approximately $500,000.

Road Work in Milwaukee County, Wisconsin, will cost approximately $550,000 this year, according to estimates. Contracts for 11 miles of paving have already been awarded, the total bid being $99,517.

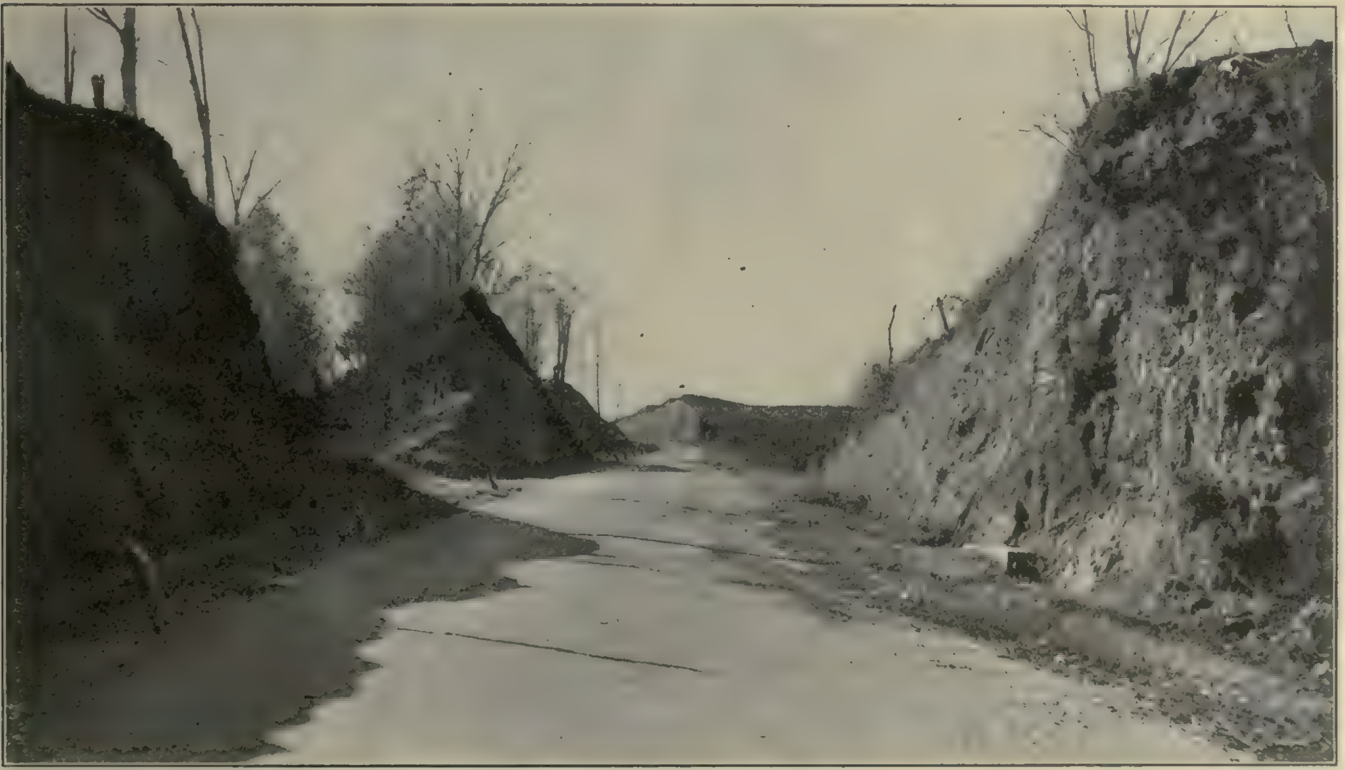
The Maryland Legislature is considering the construction of a boulevard to connect Annapolis, Md., and Washington, D. C. The plan provides for the appropriation of $250,000 each by the Legislature and Congress.

Contracts have been Closed in Houston, Tex., for 350,000 sq. yds. of creosoted wood blocks for paving in Minneapolis, Minn. It is estimated that 12,250,000 board feet of lumber will be required to fill this order.

Surface Treated Macadam in Warren County, Mississippi

During the past year and a half there has been nearly completed in Warren County, Mississippi, a considerable mileage of macadam roads built of Novaculite and surface treated with asphalt and slag. The work was undertaken early in 1914 following the issuance of $300,000 worth of road and bridge bonds. The work has been done under the supervision of G. R. Thomas, a consulting highway engineer of Vicksburg, Miss., to whom we are indebted for the information which follows.

The work comprised, besides surfacing, the relocation of many of the roads. The topography is very irregular, and in improving the roads many changes have been made in both alignment and grade. The old highways were generally located on ridges and varied in width from 12 to 20 ft. The banks were nearly vertical and from 5 to 40 ft. in height, and in not a few places trees had fallen across the road, resting on opposite banks and completely covering it. In the work which has been done, the curvature has been reduced about 40 per cent., but the alignment is still, to quote Mr. Thomas, "almost a series of reversed curves." The old roads had many grades exceeding 20 per cent. These excessive grades, with one exception which is 6½ per cent., have been reduced to a maximum of 6 per cent.



HALL'S FERRY ROAD, WARREN COUNTY, MISS.—NOVACULITE WITH ASPHALT AND SLAG SURFACING—SHOWING CHARACTER OF GRADING WORK.

The new roads are graded to a width of 24 ft. on embankments and 30 ft. in cuts. The cut slopes are ¼ to 1 and, in the opinion of Mr. Thomas, will be vertical in a few years owing to the peculiar soil conditions. In surveying for relocation it was necessary in some places to take from six to twelve cross sections per hundred feet. The work was done with a Locke hand level and the excavation and embankment were balanced to within 200 cu. yds. per mile. The total amount of grading was 447,916 cu. yds., an average of about 15,700 cu. yds. per mile. In only two places on the entire work was it necessary to borrow material in large quantities, and the overhaul was kept within a cost of $606.

The bonds to provide money for the improvements were sold in April, 1914. Surveys were commenced in February of that year, and on May 27 a contract for the construction of 15.4 miles of road was advertised and awarded to the Owens Construction Co., of Longview, Tex. Work was commenced the following month. In November, 1914, this company secured a second contract for 8.12 miles, and in May, 1915, H. F. Garbish, of Vicksburg, Miss., was awarded a contract for 5 miles. The work to be done comprised grading, the laying of the macadam surface and the application of a surface treatment. Of the 28.52 miles of road included in these contracts, 15.40 had been completed early this year. Of the remainder, 10.62 miles had been graded and paved and 2.50 miles had been graded only.

The surfacing consists of Novaculite, laid to a depth of 7 ins. loose and afterward rolled to a depth of about 5½ ins. This material is a very hard, fine-grained, siliceous rock which is quarried and sold under the name given. It is white to bluish gray in color, is brittle but tough and breaks into irregular, angular pieces. That used in the Warren County work was obtained from the Novaculite Paving Co., of St. Louis, Mo. Mixed with the material was a ferruginous clay, which, Mr. Thomas states, has excellent cementing properties.

For road purposes, the rock is quarried and broken into four sizes, as follows: No. 1, 4 to 2½ ins. in size; No. 2, 2½ ins. to 1 in. in size; No. 3, 1 to ½ in. in size, and No. 4, ½ in. to dust. The material is spread in layers and rolled as is stone in ordinary macadam work, the road machine being used constantly to preserve the crown of the road. According to Mr. Thomas, excellent results can be obtained

BALDWIN'S ROAD, WARREN COUNTY, MISS.—NOVACULITE MACADAM, SURFACE TREATED.

IMPROVED ROAD IN WARREN COUNTY, SHOWING EFFECT OF RELOCATION ON LINE AND GRADE.

by using No. 2 and No. 3 sizes, mixed, in applying the second course.

After the roads had been used for from six to eight months, an asphalt surface treatment was applied on 15.40 miles, the two contracts under which it was done being awarded to the Merrill Road Improvement Co., of Chattanooga, Tenn. Under the first contract the company furnished all materials and was paid by the square yard of surface. Under the second contract the county furnished the materials, the company doing the work. In applying the treatment, the road was first cleaned with a rotary wire broom and, where necessary, by additional hand sweeping. Hot asphalt was then applied under pressure at the rate of about .65 gal. per sq. yd., Mexican asphalt being used. Immediately afterward, slag from ⅛ to ¼ in. in size was spread over the road with shovels. About 210 tons of slag per mile of 16-ft. roadway were used.

The total cost of the work was $320,381.69, which was divided as shown in the following table:

Vincennes Bridge Co., Vincennes, Ind., bridge material	$2,172.00
W. T. Young Bridge Co., Nashville, Tenn., bridge material and contract	4,415.00
Vicksburg Boiler & Iron Works, Vicksburg, Miss., bridge material	2,507.55
Southern Mfg. Co., Columbus, Miss., culvert pipe	7,473.09
Novaculite Paving Co., St. Louis, Mo., road metal	23,725.64
A. & V. R. R. Co., freight	64,293.68
Owens Construction Co., Longview, Tex., construction work	167,837.18
H. F. Garbish, Vicksburg, Miss., construction work	21,070.63
Merrill Road Improvement Co., Chattanooga, Tenn., asphalt surfacing	14,177.45
Birmingham Slag Co., Birmingham, Ala., slag	386.97
Engineering	12,322.50

The amount paid to the Owens Construction Co. included all concrete work in bridges and elsewhere. All the bridges and large culverts are of reinforced concrete or steel and were designed to carry a load of 12 tons. Most of the small culverts are of cast iron pipe.

The roads which have not already been given the surface treatment will be treated during the coming summer.

The Board of Public Works of Watertown, N. Y., has decided to do its own road oiling this year. The purchase of 30,000 gallons of oil, a tank of 11,000 gallons capacity and a road oiler has been authorized.

The Board of Supervisors of Saratoga County, N. Y., has appointed a committee with power to purchase rights of way for the construction of state highways and to institute condemnation proceedings if necessary. The committee is also authorized to purchase gravel pits and spoil banks that may be needed in road construction.

The City Asphalt Plant of Camden, N. J., has saved a considerable sum since its installation in 1913, according to the report for 1915 of the Camden Highway Department. The plant was built at a cost of $11,375. Prior to its establishment, the price of asphalt pavement construction amounted to as high as $2.25 per sq. yd., it is stated, while since the establishment of the plant the cost for similar work has been reduced to $1.90 per sq. yd. During 1915 the department paved 15 streets with sheet asphalt and resurfaced 5 streets, and, the report states, "the difference between the actual cost of construction and the amount charged ($1.90), which is paid by the abutting property owners (otherwise the saving), goes directly into the city treasury."

ANOTHER VIEW ON THE HALL'S FERRY ROAD SHOWN IN ILLUSTRATION ON PRECEDING PAGE.

JACKSON ROAD, WARREN COUNTY, MISS.—NOVACULITE ROAD WITH SURFACE TREATMENT.

Papers Presented at the Thirteenth Annual Convention of the American Road Builders' Association

Note: The three papers printed on this and the following pages complete the list of those presented at the Thirteenth Annual Convention of the American Road Builders' Association at Pittsburgh, Pa., Feb. 28-Mar. 3, 1916. The others were printed in "Good Roads" for March 4.

The Coleman du Pont Road

By CHAS. M. UPHAM

Chief Engineer, Coleman du Pont Road

Many of the roads in Delaware are especially well located to form the backbone of a perfect system of highways. With the addition of but a few new roads, much desirable country could be opened up, and direct lines of communication could be established between the principal points in Delaware.

In the northern county the greater number of the main routes of travel have been improved with some kind of bituminous pavement; in the middle county a smaller percentage of the main lines of travel are improved, while in the southern county, with the exception of some gravel roads, very few of the highways have been improved. Many attempts have recently been made to make sand-clay roads, but, with very few exceptions, the results are not wholly satisfactory to the traveling public. There are certain times in summer, after a long continued dry period, that the dry, fine sand makes travel difficult. In the winter, after the ground has become thawed, or after a long heavy rain, travel is nearly impossible. On many of the secondary roads, the natives of southern Delaware are carting their loads over roads that have not been repaired or maintained in their memory.

Southern Delaware is noted for the production of strawberries and peaches. As many as sixty carloads of strawberries have been shipped from a single town in one day. Most of these berries were carted over roads deep with sand, where it took as many mules to haul eight crates of strawberries as it would to haul forty crates over improved roads.

The Coleman du Pont Road, which will extend through the entire length of the state, from the Maryland boundary to the Pennsylvania boundary, will open up a large amount of country that has not as yet known the benefits derived from good roads, and will also serve as a direct line of communication for the entire length of the state. The portion of the Coleman du Pont Road now under construction is the section in Sussex County. This is the southern county and the part of Delaware that is most in need of improved roads. About twelve miles of the du Pont Road have been completed, and with the six concrete mixers now ready for work, speedy progress is expected as soon as construction is resumed in the spring.

The alignment of the du Pont Road is practically straight, averaging only one curve in every four miles. The curves are of large radii and thus make less apparent the deviation from a straight line. The longest distance between curves is about twelve miles; the shortest is over one mile.

In the southern part, the grades are slight, there being only two grades that exceed one per cent. In the central part of the state, the ground becomes more rolling and continues this way as the line goes north.

Especial attention was paid to securing proper drainage. A drainage survey was made, which comprised the locating of and the taking of elevations in all ditches and streams that cross the du Pont Road, or that are near enough to serve as a part of the drainage system of the road. The area of this survey generally extended about one half mile each side of the road. The drainage survey assisted to a great extent the principle of getting the water "off and away from the road as soon as possible."

Generally speaking, the surface soil along the du Pont Road is sand or clay, or a mixture of these, but, in some instances, the road traversed swamps and depressions where the surface consisted of a black muck that became very hard in dry weather, but when wet, became very soft and slimy. This black soil was capable of absorbing and retaining a large quantity of water. For this reason, this soil was removed and replaced with more suitable material.

The grading in practically all places was light. In general the subgrade was left about 2 ins. high. This was rolled thoroughly with a roller weighing at least 6 tons. It often appeared that the roller would break up the subgrade instead of compacting it, but after this loose material was shoveled away, it left a smooth, compact subgrade showing the roller to have broken up the surface of the subgrade, but to have compacted it underneath.

While several kinds of wearing surface are being constructed for the sake of experiment, the greater part of the road will be constructed of reinforced concrete.

The concrete pavement is 14 ft. wide, 7 ins. deep in the center and 5 ins. deep on the sides, on a flat subgrade. The proportions of the ingredients used in the concrete were 1 of cement, 2 of sand, and 4 of stone. The contractors used bottomless measuring boxes in the wheelbarrow, in order to secure the same amount of stone and sand in each batch. Hydrated lime was used in various quantities according to the different experiments that were made. Each batch of concrete was mixed for 1½ minutes. The subgrade was wet before the concrete was deposited, and care was taken that all batches were thoroughly spaded together so that a homogeneous mass might result.

No uniform length of slab was adopted, for it was decided that in order to learn what the maximum length of slab without cracks would be, joints should be placed only when the concrete mixer stopped for more than 15 minutes. This resulted in some very long slabs, the longest being 460 ft. Transverse cracks have appeared in the longest slabs; and, because these cracks occurred at regular intervals and knowing the subgrades, materials and construction to be especially good, it would seem that practically all of these cracks were due to contraction and followed a definite principle. The result will assist in determining the maximum length of slab possible to construct without transverse cracks, especially under conditions as they are on the du Pont Road. Armor protection plates were used at each joint.

Nearly all the concrete pavement was reinforced, the reinforcement being placed 2 ins. from the surface in all instances. The reinforcement did not prevent the transverse cracks entirely, but has probably reduced them in number. No longitudinal cracks have appeared.

Although five different kinds of reinforcement will be used on this section, only three different kinds have been used up to the present time. In deciding on the different reinforcement, it was the intention to keep the cost and the weight per square yard as near the same as possible. One part of the road is reinforced, for the entire width, with No. 29 American Steel & Wire mesh reinforcement. This gives the weight of reinforcement in each square yard of pavement as 2.52 lbs. Wherever the slab is less than 178 ft. long, no cracks have yet appeared. Another part of the road is reinforced for the entire width with No. 25 Kahn expanded metal. This gives the weight of reinforcement in each square yard of pavement 2.25 lbs. Wherever the slab is less than 164 ft. long, no cracks have yet appeared.

Another part of the road was reinforced with No. 25 Kahn expanded metal, for a distance of 4 ft. each side of the center line. More cracks appeared in this section than where the reinforcement extended the entire width of the pavement. Another section was reinforced with the same reinforcement for a distance of 3 ft. each side of the center line. With the exception of one slab, more cracks have appeared in this section than in either of the other reinforced sections. Lighter reinforcement of the same type has been used, but these slabs have not been inspected recently. With one exception, as the percentage of reinforcement increased the transverse cracks became fewer. The increased cost due to reinforcement was 9 cts. per sq. yd. If the reinforcement were not used and the money put into concrete, it would add but ½ in. to the thickness of the road.

On one of the sections a power templet was used to finish the concrete. This left the concrete smooth and with an even surface. It is claimed that this machine compresses the concrete. This may help to resist the abrasive wear, but has not up to the present time prevented or reduced the transverse cracks. On the other sections, the templets were made from 4 by 4 by ½-in. angle irons, bent to conform to the crown of the road. After the laborers learned how to use these they worked satisfactorily. If it could be avoided, the templet was not drawn over the pavement more than once, it afterwards being finished with hand floats made of wood or cork, care being taken to disturb the concrete as little as possible, after it was laid in place. This precaution resulted in the stone aggregate being very near the surface, or in other words, there being very little matrix or mortar above the wearing stone.

Immediately after the concrete was finished, wooden frames covered with canvas were placed over the concrete, to protect it from the sun or wind. These were kept on the concrete for about 24 hours, after which the concrete was covered with earth for a depth of 2 ins., and kept wet for a period of 14 days. After 30 days this covering was removed and the concrete allowed to harden for two weeks before traffic was allowed on it.

Great stress was laid upon the securing of satisfactory ingredients for the concrete.

All the materials were tested and inspected by the Bureau of Inspection, a department of the Coleman du Pont Road, that for the past three years has been given over to testing materials, experimenting and research in highway methods and materials. The laboratory of the du Pont Bureau of Inspection is located in Wilmington. The bureau has under observation at present, many experiments that were commenced in 1912. Considerable work was carried on with asphalt pavements, especially those of fine aggregate.

During the past two years considerable research in concrete has been carried on. Besides carrying on the private work of the du Pont Road, the Bureau of Inspection is acting as the consulting engineers for several towns and boroughs as well as private concerns and individuals. On account of this consulting work, the entire field of road building and paving is practically covered by the bureau. The laboratory is fully equipped for all kinds of physical testing with ample facilities for chemical testing.

By having the du Pont Bureau of Inspection take care of the tests and inspection, all materials were ready to use as soon as they arrived at their destination, and no delays were caused by rejected materials.

After considering various aggregates, it was seen that it was economical to use crushed trap rock; the requirements being that it should have a French coefficient of wear of at least 17 and should be the run of the crusher that would pass a 1½-in. ring and be retained on a ¼-in. ring. Tests of samples taken from the field showed the average French coefficient of wear to be 17.7 and the voids to be 45 per cent. The stone was shipped from Pennsylvania, a distance of over 100 miles. The inspection of the stone was made at the quarry.

There is much sand in the surrounding country, but it was decided after many tests, that none of it was suitable for concrete work. The sand finally used was a dredged river sand of exceptionally good quality. This was loaded on cars and shipped about 90 miles. Samples were taken when the sand was loaded on cars, and the tests were completed while the cars were in transit. The grading of this sand was especially good, the large particles being nearly ¼ in. in size. By using this sand with the trap rock aggregate, there was secured an exceptionally well graded and dense mixture of concrete ingredients, from 1½-in. pieces of stone to the fine particles of sand.

All the cement came from the Lehigh Valley district and passed the standard requirements of the American Society for Testing Materials. It was tested and inspected at the cement mill.

With but two exceptions the water used in the concrete construction, was obtained from driven wells; in one instance it was obtained from a mill pond, and in the other from a small stream. The tests showed this water to be as good for concrete, as the well water. All the water was tested at regular intervals.

In order to keep complete records, a testing engineer made sieve analyses of the stone, and tested the sand for voids, three times each week. He also made slight changes in the proportions of the ingredients if found necessary. The testing engineer also took samples of stone to determine its toughness, and also took samples of sand and cement to be sent to the laboratory for a check test. The work of the testing engineer was not only to check up the quality of the materials, but also keep complete records of the quality.

A few concrete cubes were taken and crushed at the laboratory of the Bureau of Inspection. These were taken mostly to determine just what increment of strength was obtained by increased mixing of the ingredients. Not enough samples have been tested to draw any definite conclusions, but four sets of tests showed that using the same ingredients, a 1½-minute mix has thirteen per cent. more compressive strength than a ½-minute mix.

One set of samples showed that by mixing concrete 4 minutes, the compressive strength of the concrete was increased 32 per cent. over that of a 30-second mix.

With the present concrete mixers it is hardly practical or economy to call for more than a 1½-minute mix.

A number of experiments, using different amounts of hydrated lime up to 10 per cent. by volume, were performed. The lime was placed in the hopper with the other ingredients. While sufficient time has not elapsed to draw any definite conclusions, the results promise to be interesting. The only conclusions that can be drawn now, as to whether or not the lime is a benefit, are based on the number of transverse cracks that have developed, in the different slabs. On one section where no lime was used, the longest reinforced slab that has not developed a crack is 191 feet. When 10 per cent. by volume of lime was used, the longest slab to develop no cracks was 210 ft. In another instance, a slab without reinforcement and using no lime has developed two cracks breaking the slab up into three slabs of 299, 118 and 126 ft. In two slabs where 10 per cent. lime was used, no cracks have yet developed. The lengths of these slabs are 336 and 210 ft.

On another section the longest slab without lime, showing no cracks is 167 ft. When 5 per cent. lime was used, the longest slab without a crack was 245 ft.; when 10 per cent. of lime was used the longest slab, showing no cracks, was 294 ft. While these data are not sufficient to permit drawing definite conclusions, they do, however, advocate the use of lime. Much more experimenting will be done along this line and at the present time, the du Pont Bureau of Inspection is carrying on quite extensive laboratory tests with cement mortars, with and without the addition of lime.

Circular letters were sent to five resident engineers and three inspectors, who had never had any experience with the use of lime, asking them to give their opinion in regard to its use. In all but one instance, the replies advocated the use of lime. In each instance, the lime was claimed "to make the concrete more plastic;" "to delay the set;" "to make it easier to draw the templet;" but, "harder to hand float the surface," as it made the matrix "stickier."

The work was very carefully inspected, by men who had had considerable construction experience. Previous concrete road experience was taken into consideration, and standard concrete specifications were referred to. With the exception of the time of mixing, and a few other little details, the specifications are practically standard.

Great stress was laid on securing the same consistency of all the concrete in order that segregation or the settling of the larger pieces of aggregate might not take place. In other words, a constant consistency was desired, in order to insure uniform wear.

In connection with the consistency of the concrete, the specifications called for the water being introduced by an "arrangement that would assure the same amount of water being used in each batch." It was found to be impossible to obtain this result exactly on account of varying percentages of moisture in the aggregates and because of the mechanical arrangement for the introduction of the water into the concrete mixing drum. A device that will practically overcome this has been devised, and it is hoped that it can be attached to the concrete mixers that will operate on the du Pont Road this season. This will mean concrete of the same consistency, hence more even wear.

This road is a gift from Mr. T. Coleman du Pont to the State of Delaware and will be presented upon its completion.

Foundations for Road and Street Pavements

By JOS. W. HUNTER

First Deputy Commissioner, Pennsylvania State Highway Department

The object of a pavement is to secure as nearly as possible a uniformly hard, even and durable surface upon which the traffic must pass. Upon the foundation of a road depends its strength, mainly to resist the impact force or blows of heavy traffic. Not to any considerable extent, nor necessarily, should the pavement support the weight of heavy loads and unless the pavement is supported by or rests on a firm and solid foundation, it will soon become rutted and full of depressions. To insure the stability of a pavement, it is necessary to have as firm and as good a foundation as for any other structure. A foundation once put in cannot be changed easily.

Bad foundations ruin any structure and invariably cause bad pavements. With a good foundation, the wearing surface depends on the quality of the material used for paving, and on the manner in which it is laid. As a general rule, the subgrade or subfoundation does not receive the attention it should in construction; it cannot be too carefully prepared. It should be thoroughly drained and compacted, soft material removed and fills of any considerable depth, say three feet or over, should be allowed to settle for a period of from six to twelve months, before the foundation, which is to carry the wearing surface, is placed thereon. It is the subgrade that virtually carries the load and resists the blows of heavy traffic. The camber or slope of the subgrade should be the same as that of the finished pavement wherever practical. This part of preparing the subgrade should be given particular attention where a pavement is to be laid on a fill or on a surface that may have been disturbed even three months and in some cases a longer time prior to the laying of the pavement.

It is proposed to divide the subject under discussion, "Foundations for Road and Street Pavements," into two classes, *Natural and Artificial.*

A *Natural Foundation* is one where paving material is laid directly upon the subgrade. Hard shale, gravel or a sandy loam when properly prepared makes a foundation upon which can be laid to advantage bricks, stone block, macadam or concrete. In cases where the natural foundation can be used to advantage for a brick or stone block pavement a sand filler should be used. The writer believes that a wire cut brick, laid in such a manner, will make a good and lasting pavement at a minimum cost for construction and upkeep.

Before concrete is laid as a pavement on a natural shale or earth surface, there should be spread a layer of cinders or crushed stone at least six inches in depth as a cushion and to keep the moisture away from the base of the pavement. Where concrete is laid directly on the earth, the moisture therefrom drawn into the concrete by capillary attraction will in a comparatively short time cause a disintegration or breaking up of the pavement. The cinder or crushed stone may not be necessary when the concrete is used as a foundation upon which to place a wearing surface of other material, but it would be good practice under most conditions to use either for drainage purposes. The construction would be better and in a great measure lessen the number of cracks in the concrete surface. Concrete as a pavement laid upon a telford foundation where the macadam was washed off showed no cracks after being down for more than eight years.

A natural foundation of gravel, containing sufficient loam to bind it, is one upon which a pavement of bricks, stone blocks, and macadam can be laid to advantage. A sand filler should be used. The gravel upon which concrete is to be placed should be practically free of loam or clay. When a sandy soil is used as a natural foundation, it should be bonded with just enough clay to hold it in place until the pavement is laid. A water bound macadam pavement laid upon a gravel foundation containing a sufficient amount of clay or loam to allow of its becoming thoroughly compacted will last longer than if laid on any other foundation. The macadam surface very rarely disintegrates. This is particularly so when the pavement is of good hard limestone. Hard shale, when properly shaped and thoroughly drained, forms an excellent foundation for a macadam pavement, and if covered with a 1½-in. sand cushion makes a first-class foundation for a brick or stone block pavement. A sand filler can be used. The writer knows of a wire-cut brick pavement laid on a clay subgrade, with cinder as a cushion and sand for a filler, that has been in use for more than twenty-five years. This pavement has been subjected to exceedingly heavy traffic and is still in good condition.

Artificial Foundations

Among the artificial foundations suitable upon which to lay a pavement to meet the requirements of traffic are concrete, rubble concrete, being rubble stones set on edge, but not in contact and the spaces between filled with concrete; a telford base laid with either rubble or cobble stones, with the interstices well and tightly filled and broken stones laid as in a macadam road. The character of foundation to use will depend on the volume of traffic and to a greater or less extent on the type of surface to be placed thereon.

Concrete has become an approved foundation for a brick, stone block, asphaltic block, wood block or an asphaltic concrete pavement. The necessity of using a cushion on the concrete base is one about which opinions differ.

The writer is of the opinion that when a sand cushion is used much, if not all, of the rumbling in brick pavement can be eliminated by the use of a sand filler instead of a cement grout. Sand as a cushion will, as the bricks are being laid, work up between them. The water in the grout will moisten the sand and for a time hold it in place, but during hot weather the sand will become dry and settle or shrink, thus leaving a void that is never filled, which separately or in conjunction with the buckling of the monolithic surface gives an opportunity for the rumbling noise so often heard when traffic passes over the pavement. If a cement grout is to be used, the brick should be set in a bed of cement mortar from ½ to ¾ in. thick, so that the whole structure will be monolithic. The mortar should be composed of slow setting Portland cement and clean sharp sand in the proportions of one part of cement to four parts of sand, mixed to the consistency of damp sand, but not slushy; and care must be taken to spread the mortar evenly with a templet. Upon such a bed of cement mortar can be set asphaltic block, stone block and wood block for a pavement. However, the life of a wooden pavement will be longer if a sand cushion is used to absorb a portion of the shock of the traffic which passes over it.

Another method of laying a brick or stone block pavement upon a concrete foundation is to cover the concrete with from ¼ to ⅜ in. of tar and set the brick or stone blocks therein, using cement grout as a filler. The tar will work up between the joints of the bricks and meet the cement grout and thus prevent the rumbling which is characteristic of a brick pavement. A ¼-in. tar surfacing should be placed on a concrete foundation before placing thereon an asphaltic concrete pavement.

One of the principal causes of the disintegration and partial failure of bituminous macadam and asphaltic cement pavements that have been laid on an old macadam foundation without careful preparation or reconstruction is due to the lack of sufficient drainage in the subgrade. The moisture generated in the subgrade passes through the macadam and evaporates at the surface. The bituminous material of any kind acts as a waterproof covering and prevents the evaporation and causes a concentration, of the moisture and eventually a soft spot in the road appears and a breaking up of the pavement begins. The moisture in addition to concentrating in the base of a subgrade by reason of capillary attraction attacks the asphaltic or bituminous pavement from beneath and sooner or later ruins it. The more free carbon in bitumen, the greater the absorption. As a matter of safety an old macadam construction to be used as a foundation for a bituminous pavement of any kind should be brought to a true surface by using crushed stone and then be covered with two or three inches of concrete before the bituminous mix is placed thereon. This will undoubtedly preserve the life of the pavement.

A telford foundation which has been used in the original construction of a telford water bound macadam road, from which the macadam has been worn or otherwise removed, makes an ideal foundation when brought to a true surface by the use of concrete upon which to lay a bituminous pavement; the drainage being nearly perfect, provided that the stones were originally set on a properly prepared subgrade. This construction prevents any concentration of moisture and a first-class foundation upon which to lay a brick, stone block, or asphaltic block pavement. Telford construction makes a good foundation for a concrete pavement.

When roads are reconstructed with the view of utilizing in the future such reconstruction as a foundation for some form of pavement, the writer strongly urges the telford method of construction as being the most practical and as having a greater future use.

It is recommended in cases where the macadam has worn and conditions do not warrant the construction of any other form of pavement, that a telford base be substituted for the macadam with a view of being able to use it in the future as a foundation upon which to lay another form of pavement.

In conclusion the principal essentials to be considered in determining the construction of a foundation for a pavement are first drainage and the careful preparation of the sub-base or sub-foundation. The life and usefulness of the whole structure depends on this essential. Then the kind and amount of traffic must be carefully considered and the character of the surfacing to be placed on the foundation must be determined. Without careful attention to the essentials, a foundation will fail and consequently the pavement will be ruined.

Recent Tendencies in Stone Block Pavements

By CHARLES F. KNOWLTON
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In this short paper on stone block pavements, I must of necessity describe only such kind of stone block pavements as are being laid in New England. The methods we use there might not be suitable for other sections of the country where material and conditions are entirely different.

Stone block pavements have been laid from the earliest times, of which we have any record, in various countries wherever permanence and durability was the governing factor. In the early Roman period the stone pavements were made of large irregular shaped stones, often 2 to 3 ft. in depth, with the smoothest face on top. The joints were filled with smaller stones wedged in with mortar.

In this country, the earliest stone pavements were composed of rounded field or beach cobbles laid on sand with joints filled with gravel. The ancient City of Panama had streets paved in this way when the pirate Morgan destroyed the city in 1680, good examples of which may be seen today among the ruins. Many of our coast towns in New England have cobble paved streets in use today that were laid 100 or more years ago.

When quarry split rectangular or cube paving blocks came into use, New England was especially favored by having so many granite hills within its borders and the Maine and Massachusetts quarries did a thriving business supplying the Atlantic and Gulf Coast cities with paving blocks.

The blocks used in the period before the war were generally 12 ins. square on top and 8 ins. deep. These were laid on the natural soil in a sand bed with sand joints. This made a durable pavement, but the surface was too rough and the blocks would tilt up on an insecure foundation.

Shortly after this time, the theory was advanced that "the smaller the block the smoother the surface" and a 6-in. cube came into general use in many of our cities. As these were laid then on a sand cushion only, it was found they would settle and cause an uneven surface, and so, many cities began to call for paving blocks of different dimensions until it became customary to use a block of 7 to 9 ins. deep, 4 to 5 ins. wide and 9 to 14 ins. long. About 1880, concrete foundations for street paving came into general use and all the large cities began to use concrete foundations for all classes of paving.

About 1905 some Massachusetts quarry owners inspected the paving laid in the City of Liverpool, where 4-in. cubes on a concrete base were giving excellent service. They then reasoned that it was ridiculous and expensive for us to cut and transport a granite block 8 ins. deep and then lay it on a 6 or 8 in. concrete base. If 2 ins. depth of asphalt, 4 ins. depth of brick or 3½ ins. depth of wood block would stand up on a concrete base what was the sense of using such a deep granite block?

This line of reasoning caused them to adopt a block 4 to 4½ ins. deep, 3½ to 4½ ins. wide, and 6 to 12 long. Laid on a concrete base with cement grouted joints, this proved to be an ideal pavement and opened up an era of improved granite block paving.

The engineers of some of the large cities hesitated to make such a radical change from a deep block to such a shallow block, but made concessions in favor of shallower blocks. The consequence of this was the paving cutters were obliged to cut different sizes for different localities, but the requirements were more strict as to the quality of the stone and the fineness of the cutting.

In 1912, an effort was made by a committee of the officials of the large cities to standardize paving specifications and resulted in recommending a special size paving block to be called the "standard." This was not so universally adopted as was expected and as a result the paving block manufacturers are at present turning out a number of different sizes and grades of granite paving block, each known among the trade in New England by a special designation.

A block 4 to 4½ ins. deep, 3½ to 4½ ins. wide, and 6 to 12 ins. long, will require about 31 blocks to a square yard with joints not to exceed ¾ in. in width.

The "standard" size block is 4¾ to 5¼ ins. deep, 3½ to 4½ ins. wide, and 8 to 12 ins. long, cut to lay about 28 blocks to a square yard with joints not to exceed ½ in. in width.

The "N. Y. special" size block is 6 to 10 ins. long, with ⅜-in. joints.

The "Boston special" size block is 5 to 5½ ins. deep, 4 to 4½ ins. wide, and 8 to 12 ins. long, joints not to exceed ½ in. in width.

The "6-inch" size block is 6 to 7 ins. deep, 3½ to 4½ ins. wide, and 9 to 14 ins. long, cut to lay about 25 blocks to a square yard with joints not to exceed ¾ ins. in width.

The "city" block is 7 to 8 ins. deep, 4 to 5 ins. wide, and 9 to 14 ins. long, cut to lay about 23 blocks to a square yard with an indefinite joint.

The "track" block is 5½ to 6½ ins. deep, 3½ to 4½ ins. wide, and 6 to 12 ins. long, rather rough cut and with an indefinite joint.

In addition to these regular trade sizes, the manufacturer is often called upon for special sizes for special conditions, among which is the "durax" size. These are cubes of from 2½ to 4 ins. It is obvious that so many sizes of granite block leads to confusion and irregularity in method and cost of construction and in the pavement surface.

During the year 1915, the Granite Paving Block Manufacturers of the United States decided to confine their production of blocks to three sizes, except where specials were called for to meet some peculiar requirements, like track paving, etc. These three sizes are:

The "standard" size block as given before.

The "shallow standard block," size 4 to 4½ ins. sq. and 7 to 11 ins. long, cut to lay with joints not exceeding ½ in. in width.

The resurfacing blocks, designed to be used for resurfacing on original foundation when asphalt, wood block, or brick pavements, are to be replaced, size 3¾ ins. to 4½ ins. wide, 3½ to 4 ins. deep, and 7 to 11 ins. long, cut to lay with joints not exceeding ½ in. in width.

These sizes and all special blocks are all cut and split by hand labor, have square edges, smooth surfaces and lay with close joints.

All of these sizes may be termed "improved granite blocks."

Improved granite block, having square edges, smooth surfaces and close joints, are usually laid on a concrete foundation.

The "6-inch," "city," and "track" are considered as rough cut blocks of the old type and are laid with wide joints, generally on a gravel base and with sand or gravel joints.

It was this type of granite block pavement that was in disrepute for so many years. Blocks were carelessly cut out of waste or rejected granite at the quarries, were carelessly inspected or not inspected at all, and often laid upon insecure sub-soil by incompetent men. The result was anything but a smooth surface, even at first—and after a few seasons of frost and rain the numerous depressions made it still more objectionable. The sand in the joints made mud in wet weather and dust in dry weather. The edges of the blocks would wear off causing the block to become rounded or "turtle-backed" and the pavement became a noisy, dirty pavement with durability as its only redeeming feature.

No wonder the public demanded smooth, sanitary, noiseless pavements and encouraged the use of various pavements other than granite! But it was soon apparent that these smooth pavements lacked the necessary quality of durability and then engineers and contractors really began to improve granite block pavements and give them the qualities they lacked.

An association of granite paving block manufacturers was formed and by cooperating with engineers and contractors, caused a marked improvement in the quality and character of granite blocks. This, coupled with new methods of construction, has produced a stone block pavement that is smooth, but not slippery, clean and sanitary, easy of traction, not noisy, low in maintenance cost, easily cleaned, suitable for all kinds of traffic, and above all, so durable that it is the most economical pavement that a city or town can lay within its borders.

No engineer should accept or specify a stone block pavement which failed to result in an even surface in every way acceptable for both horse and automobile traffic. To secure this smooth even surface, it is necessary for the engineer to require a carefully split stone block having no projections exceeding ⅜ in. from a true plane, and that the blocks be laid in the street on a properly drained sub-foundation, a substantial concrete foundation, and with close, even joints, and these joints be filled with a rich mixture of cement grout or with a bituminous filler of asphalt or pitch.

The use of the two different fillers is largely a question of prospects of future openings being made in the pavements. If frequent openings and quick repairs are necessary, the bituminous filler is more convenient and economical, openings can be made easily and the surface replaced satisfactorily without loss or wastage of blocks. Where openings are not apt to be frequent or where traffic conditions will allow the street to be closed for a period to allow the cement grout filler to properly harden, the cement filler should be used and will give a smooth surface, protect the edges of the blocks, and give better results usually than the bituminous filler.

A firm subgrade and a strong concrete foundation are just as essential in laying a stone block pavement as they are in laying other types of smooth pavements. It is true, however, that many grouted stone block pavements have been laid without a concrete foundation and some have been very successful, but they have been in small cities and towns where the traffic could not be considered heavy and where the sub-soil is especially good. Danger lies in the liability of the blocks to settle under heavy loads; if this occurs in the slightest degree the bond of the cement is broken and it scales off and loosens in the joints.

In this type of pavement it is necessary to use a deep "city" block and have the cement grout fill the joints their entire depth to get the necessary stability.

The cost of handling and transporting these deep and heavy blocks is nearly twice that of the small blocks and in localities far removed from the quarries it will be found that a 4-in. stone block can be laid on a concrete foundation, requiring no more excavation and less labor and cement, for less money and will give a more permanent smooth surface.

In some cities of the West and Southwest, where granite blocks are almost out of reach on account of transportation cost, sandstone and other kinds are used for stone block pavements. I have had no practical experience with this type, but am of the opinion that these soft and porous blocks should have small surface dimensions and be laid with close joints and that the filler should cover the entire surface, filling the pores and helping to resist the abrasion of the surface.

As to the construction of improved granite block pavements, I will describe the methods we used in constructing nearly a million square yards in Massachusetts and Rhode Island in the past ten years, every yard of which is in perfect condition today with no expense for maintenance. Most of the pavements were laid under our own standard specifications, backed by our 5-year maintenance guarantee. Part of this work was obtained under competitive bidding by public advertisement, part under invitation bids, part under a cost and percentage basis and a large part was given us without competition. In all cases, the cost to the city, town or corporation was the same, taking into account the material market and local conditions.

In excavating and preparing the subgrade, great care is taken to have the subsoil thoroughly compacted by a steam roller and hand tamps, all soft and spongy material is removed and good firm dry material takes its place, especial care being taken to see that newly filled trenches are well compacted. The subgrade is left smooth and exactly parallel with the proposed finished grade.

On this subgrade a well mixed concrete base is laid 6 ins. in depth. On good undistrubed natural soil a 1:3:6 mixture is strong enough; on filled ground where underground pipes have recently been laid a 1:2½:5 mixture should be used.

We usually lay our concrete foundation by the grouting and compression method. Many tests made show that for equal thickness, the compressed concrete is 33 per cent. stronger under a bending strain and 40 per cent. stronger under a compression test, than ordinary mixed concrete, hence under this method the thickness of a concrete foundation can be reduced to 4 or 5 ins. with perfect safety and with a considerable saving in costs.

A layer of egg-size crushed ledge stone is placed on the subsoil and rolled to the required thickness. A Portland cement grout is then poured into the stone and the stone rolled during this process until all the voids are filled and the grout flush with the surface. The grout is mixed in different proportions according to the thickness and character of the wearing surface of the pavement. One part of cement and four parts of sand is most generally used. This is mixed in a patented grout mixer operated by a gasoline engine and which is self-propelling.

The sand, cement and water are carefully measured by volume for every mix and the grout is distributed evenly into the stone through pipes long enough to cover the entire width of the foundation. Concrete foundations laid in this manner have proven very successful. They can be laid much faster than by the ordinary method and cause less obstruction to travel in the handling of materials. The surface of the concrete base is left smooth and exactly parallel with the proposed surface. Upon this we place our sand cushion. This should never be more than 2 ins. nor less than 1 in. in depth. We prefer a maximum of 1½ ins. In some cases we have used a dry mortar bed, ½ to 1 in. in depth, mixed in proportion of one cement to three or four of sand, but do not recommend it. When it sets up the pavement is too much of a monolith and is noisy. A sand cushion deadens the noise of traffic and furnishes a little elasticity to the pavement, which is essential.

The cushion is to compensate for any irregularities in the depth of the blocks and to give a uniform bearing to the bases. In the old type of blocks the variation was 1 in. and sometimes as much as 2 ins. in the depth, hence, if shallow blocks were laid in with deep blocks, the strength of bearing would be unequal and under traffic the shallow block would be pounded down, causing an uneven surface. The improved blocks are cut with only ½ in. variation in depth and the thickness of the cushion is therefore more uniform.

The granite paving blocks are laid on this sand cushion by the most experienced pavers we can find. Blocks are laid in regular courses end to end across the street at right angles to the curb. Joints are broken by a lap of at least 3 ins.

It is important that each block in the course or row be of the same width. A narrow block should not be laid in with thick ones as that makes for an uneven width in the joints. There is sometimes a variation of 1 in. in the width of blocks and the paver should pick his blocks when laying. If he starts a course with a block 3½ ins. wide, he should lay that size to the end of the row. The next course could be blocks 4½ ins. wide and the course kept straight and the joints of uniform width.

Clean ½-in. pea stone is then scattered over the surface and broomed into the joints, only enough being used to steady the blocks while being rammed. The blocks are then rammed to a firm, unyielding bed with a 60-lb. rammer or rolled with a 6-ton tandem roller until the surface is smooth and regular.

Much depends upon the rammerman in securing an even surface. Each block must be rammed to a firm bed. If one should settle more than the other the low block should be lifted, rebedded and retamped. While the cement grout is being applied the rammerman should again go over the surface and ram down the high blocks and straighten those that have become tilted. One rammer should be used for every two pavers.

We are exceedingly careful in the selection of the granite paving blocks. They should be of medium grained granite showing an even distribution of constituent minerals of uniform quality and texture, without seams, scales or discolorations showing disintegration, free from an excess of mica or feldspar.

Usually a better selection of granite can be made by reference to past performance of any particular granite from any particular quarry than to attempt to make a selection from local tests.

We can refer to pavements that are fifteen years old and subjected to heavy traffic, that are smoother and more perfect today than when first laid, showing a wear of only about ⅛ in. in the surface; the granite blocks and the cement filler wearing evenly together without any depression in the joints.

Where a cement filler is to be used, the granite blocks need not be cut so fine and the joints can be wider than where a bituminous filler is used. We find that blocks 4 to 4½ ins. deep, 3½ to 4½ ins. wide and 6 to 12 ins. long are most suitable for this purpose and have used them in 75 per cent. of our work.

We now come to the filling of the joints in the pavements. This is the most important part of the construction, as upon it depends the smoothness and permanency of the surface.

We seldom use a bituminous filler, as it does not protect the edges of the block as they should be. After a few years the filler is worn down in the joints and the edges of the blocks become rounded and the pavement becomes rough and noisy. Nearly all our improved granite pavements have a cement filler.

We first wet the blocks until they have absorbed all the water possible and keep them wet until the grout is applied. The grout is composed of one part of cement and one part of clean sharp sand with enough water added to make it of the consistency of thin cream. This is mixed in our self-propelling grout mixer which travels on planks placed on the pavement. The grout is kept constantly agitated until it reaches the joints and every mix is exactly alike. The grout is run directly on the surface and broomed evenly into the joints.

During this operation clean pea stone, well wet, is lightly scattered into the grout and broomed into the joints. After this grout has subsided in the joints and before the initial set takes place, the surface is again treated with a grout of the consistency of thick cream which is evenly broomed over the surface until the joints are full and flush with the top of the blocks. A rubber or wood squeegee, or scraper, is then used to scrape off all the surplus cement from the surface.

The effect of this is to leave the depressions in the block filled with cement while there is none on the projections, thus making a smooth surface. When the cement is sufficiently hardened, the surface is sprinkled from a can and a fine floor brush used to brush and smooth out all irregularities. After the cement is set, the surface is copiously sprinkled and kept wet for three or four days.

All travel is kept off the pavement for six to ten days. Plenty of water is used to wash the blocks—you cannot get satisfactory results if dirty blocks are used. The joints must be open sufficiently to allow the grout to flow in and penetrate to the bottom. The cement must not be allowed to set up too quickly and in very dry weather the surface should be kept covered with wet sand for at least three days.

On a business street, we lay a felt expansion strip ½ in. thick and 6 ins. wide, along the curbstone, between the blocks and the curb. This acts to deaden the sound and prevents vibrations being carried into the buildings. Where there are car tracks in the street, the web of the rails is plastered with cement mortar flush with the outside of the head of the rail, after the foundation is laid. This allows the blocks to lay firmly against the rails and still not be affected by any slight movement of the rails.

If cars are running during the grouting operations, the shaking and vibrations of the rails may cause the blocks to "float" that is: the vibrations cause the blocks to shake and the fresh grout works down under the block forcing them up, a little above the head of the rails. In such cases the cars should be kept off the tracks until the grout has well set, in fact, it is desirable that cars be kept off during the whole time paving operations are going on and for six days after completion. If this is impossible, they should be made to travel very slowly.

As "Eternal vigilance is the price of liberty," so it is with improved granite block pavements. Careful attention to the quality and kind of materials and constant watchfulness in putting them together are the true secrets of our success.

When you lay a pavement that is going to last forty or fifty years, you cannot afford to take any chances in its construction. You should have the best of material and the most expert assistance you can get. Do not consider first cost too seriously. What does a few dollars extra amount to on the first cost of a pavement that will cost you nothing for upkeep, if properly laid, and at all times and seasons meet the demand of all classes of traffic? Quoting from John Ruskin:

"Let us have regard for posterity. Every human action gains in honor, in grace, in all true magnificence, by its regard to things that are to come. Therefore, when we build, let us build forever. Let it not be for present delight, nor for present use alone; let it be such work as our descendants will thank us for."

The cost of improved granite block pavements will vary a great deal in different localities but it may be of interest for you to know that the average cost of the pavements just described as laid in the vicinity of Boston, is, $3.25 per sq. yd.

Of the millions of square yards of these pavements in New England and in New York, I do not know of a single instance where any repairs were necessary on account of wear and tear of the pavement, when properly constructed. Any defects occurring were directly traceable to improper inspection or workmanship. If city officials would make a comparison of costs for all kinds of pavements covering a period of thirty years, they would find that the grouted granite block pavement was the cheapest in the end, besides having all of the good qualities of other smooth pavements.

Although I have not had the privilege of personally inspecting the merits of the new machine made small, granite blocks, known in the United States and England as durax, and in Germany as kleinplaster, I feel that any paper on this subject of stone block pavements would be lacking in completeness if some reference was not made to durax pavement.

There is no question about the extensive use of these small stone cubes, averaging from 2½ to 4 ins. square, in the pavements in Germany, France and England, although it is my understanding the most extensive use of this type of paving has been made in Germany.

The pavements which have been laid in the United States up to the present time, are, I am told, the equal in every respect to pavements laid in Germany and the yardages in Cleveland, Columbus, Ohio; Washington, D. C.; Louisville, Ky.; New York City, Philadelphia, Pa.; Danville, Va., and Salisbury, N. C., while small, are all standing up satisfactorily, and I believe, with the exception of a couple of cases where improper laying on the part of the contractor has produced rather inferior results, these pavements have shown no appreciable wear or deterioration.

The all-important fact about durax as well as other granite pavements, lies in the fact that granite is an enduring material. My opinion is, there would be no difficulty about the successful laying of any granite block pavements, if the contractor or city official would give the details of the specifications an honest interpretation in the actual laying.

Durax pavements properly laid, will give a wearing surface from 3 to 4 ins. thick and records of wear of granite block pavements show that any true granite suitable for paving material will not show any appreciable wear in even 20 to 30 years, when properly laid.

They are constructed in exactly the same manner as the improved granite block pavements, the only difference being in the size of the block. In this country, they cost as much per sq. yd. as larger sizes and I fail to see what advantage is to be gained in laying durax pavements, unless they are laid on old foundations, to replace worn out asphalt, brick, wood or other thin wearing surfaces.

I thank you for doing me the honor of listening to my paper and beg you to bear in mind that I am not a technical man but simply a contractor of practical experience. If you have gained any additional knowledge from this paper, I shall feel well repaid for presenting it.

Construction Field Books for Bituminous Macadam Highways

By J. T. CRAWFORD*

Construction field books are the connecting links between the plans and the completed highway. They are the plans condensed and rearranged to fit the convenience of the construction engineer. The main objects of the books are to show the highway as planned, staked and constructed.

Highway construction has characteristics that make necessary unusual treatment from the construction engineer's standpoint. In the first place several gangs are usually working on various jobs over a long stretch of highway at the same time. This fact necessitates several inspectors. It is desirable that each of the inspectors be provided with sufficient data, from the plans, to cover the job or jobs he is inspecting. Secondly, the most carefully designed highways require alterations during construction. These changes are best made in the field and should be recorded. The third characteristic is the fact that the data necessary for the construction engineer and inspectors are scattered among the bulky plans, sections and specifications. These conditions make the plans, etc., unsuitable for the use of the construction engineers. The construction field books condense and rearrange the plans to eliminate the above defects.

Connecting the paper location of the proposed highway to the construction stakes and defining the road lines, as intended on the plans, is the second function of the construction books. This consists of transferring the proposed highway location from the tie points and bench marks of the base line to the construction stakes.

Data collected during construction include records of alterations to plans and records of field measurements of completed structures. As the monthly and final estimates are based upon the latter this feature is very important.

A set of books embodying the foregoing essentials, suited to the construction of the normal bituminous macadam highway, will include grading, culvert construction, bituminous material application, stone laying, miscellaneous data and daily record. The first four are intended for the use of the inspectors under the supervision of the construction engineer. The last two are kept by the engineer in charge.

The Grade Book

In Figure 1 is shown a typical page of the grade book as it will appear in a field book. The first column data, scaled from the plans, connect the proposed center line to the base line. The distances are essential for the location of the center line. "Cut or Fill on Center Line" data are guides to assist the grading foreman and are useful when the center line grade is altered. The figures are taken from the section sheets. The center line and structures, appearing under "Plans" are not drawn to scale. The arrangement affords a means of eye-checking the construction stakes and facilitates changes in line. In general the same can be said of the "Profile." In the next column the stations appear, extending up the page for obvious reasons. These are marked on the stakes.

The proposed "Center Line Grade" elevations are taken from the plans and sections.

"Grade Stake Elevations" are copied from the survey covering this feature. They are usually included in the resurvey sections. The "Check on Subgrade" column provides space for the grading inspector to record test measurements after grading. "Center Line to Slope" distances are taken from the sections. The intersection of the proposed cut or fill with the original ground line is thus located. These distances subtracted from the "Center Line to Slope" distances give the "Stake to Edge of Slope" offsets which locate the slope stakes. The above data define the limits of earth work as shown on the plans, sections, etc. In addition to the "Stations" the stakes are marked with "(+) or (–)," "Offsets to Center Line" and "Stake to Slope" distances. If the earth work does not balance by following the stake markings the engineer will be justified in making alterations in the grade or line to remedy the condition. The column headed "Slope" shows the proposed slope of the shoulder in cut or fill. It is a check on the previous data. In the "Remarks" column will appear explanations of alterations, soil notes, etc. Alterations to profile, line or slope are shown by crossing out the original figures and insetting corrections above or below.

The records of field measurements and sketches, memoranda, orders to contractor, typical sections, etc., are recorded in the unused portion of this book if there is room, or otherwise in an additional book.

Culvert Book

In Figure 2 are shown proper headings for culvert book summary. The details of location, construction and measurement are shown in the balance of the book and referred to the summary. The references to monthly estimates are the only unusual feature. These references show the items appearing in the monthly estimates. They eliminate the chance of duplicating or omitting completed structures from the estimates. If the field measurements and amounts vary from the designed amounts the latter are corrected as in the Grade Book.

Stone Courses

The metaling is the most important and expensive feature of highway construction. Likewise, the contractor depends mostly upon this item for his profits. It is therefore essential that a means be afforded of obtaining measurements covering its construction. The usual method of obtaining the required depth is to lay the loose stone to blocks. This does not insure sufficient depth after rolling. In the "Stone" book a record is shown of actual measurements of the rolled courses before the filler is applied. It is not claimed that one measurement to a hundredth of a foot is of any great reliability but their accuracy increases with their number. Measurements taken on sides and in center every half station and averaged over 200- or 300-ft. stretches, should result in fairly accurate data. The same may be said of the widths. It may appear that most of the inspectors' time would be required to make these measurements. This is not the case. It is possible to collect these data and inspect the loose stone laying at the same time. It might be advisable to insert another column in which an additional check on elevation of the subgrade and lower courses might be recorded. Between the grading and stone gangs there is often much traffic and consequent settling. If such were the case the fact would appear in this column.

Bituminous Material Application Book

Figure 4 shows headings for the details of the application of bituminous material on the full width of road from pressure tanks. The computations involved can be eliminated by the use of a set of curves. At the finish of each car the columns are totaled and corrected for the actual area covered and the capacity of the car, in gallons.

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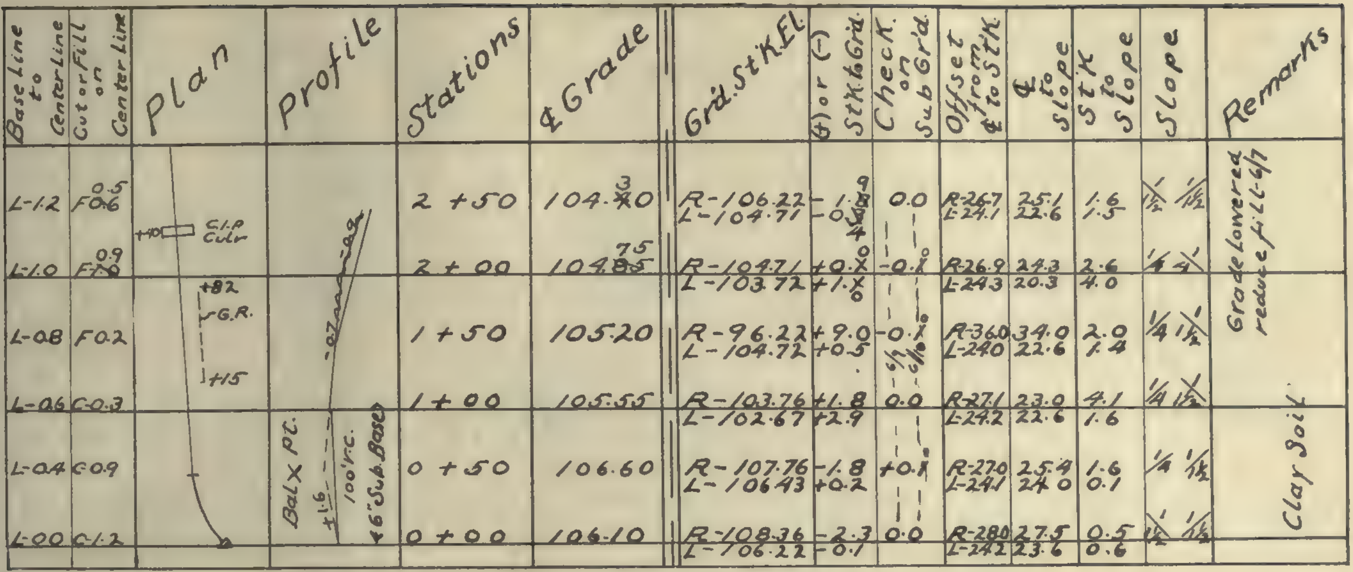
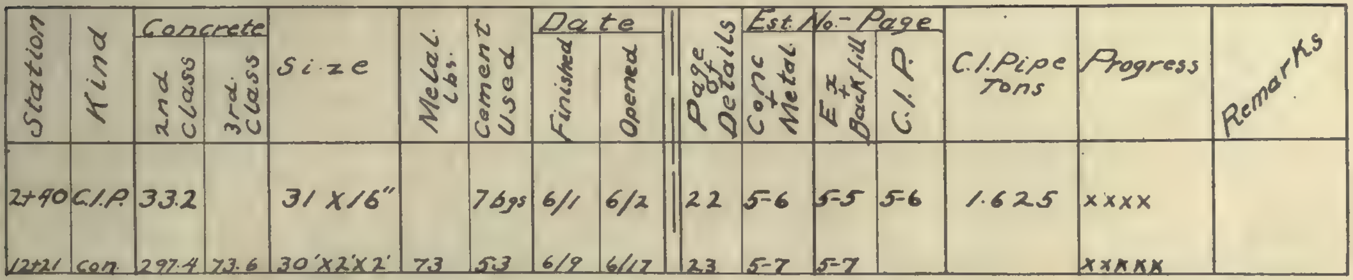

+10 C.I.P. Culv.
+82
G.R.
+15
-0.7
-0.9
Bal X Pt.
+1.6
100' V.C.
6" Sub Base
6/9
6/10

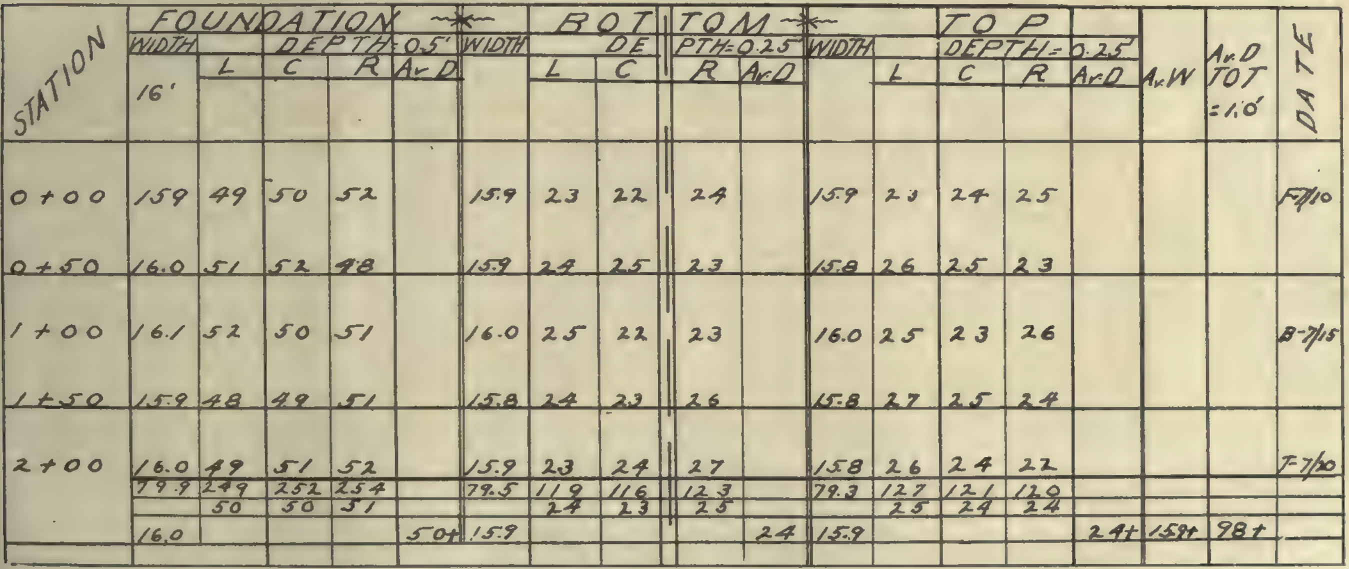
Base Line to Center Line	Cut or Fill on Center Line	Plan	Profile	Stations	℄ Grade	Grd. Stk. El.	(+) or (−) Stk. to Grd.	Check on Sub Grd.	Offset from ℄ to Stk.	℄ to Slope	Stk. to Slope	Slope	Remarks
L-1.2	0.5 F~~0.6~~			2 +50	3 104.~~4~~0	R-106.22 L-104.71	-1.8 -0.	0.0	R-26.7 L-24.1	25.1 22.6	1.6 1.5	1/2 1 1/2	Grade Lowered reduce fill 6/7
L-1.0	0.9 F~~1.0~~			2 + 00	75 104.~~85~~	R-104.71 L-103.72	+0.X +1.X	-0.1	R-26.9 L-24.3	24.3 20.3	2.6 4.0	1/4 1/4	
L-0.8	F0.2			1 +50	105.20	R-96.22 L-104.72	+9.0 +0.5	-0.1	R-36.0 L-24.0	34.0 22.6	2.0 1.4	1/4 1 1/2	
L-0.6	C-0.3			1 + 00	105.55	R-103.76 L-102.67	+1.8 +2.9	0.0	R-27.1 L-24.2	23.0 22.6	4.1 1.6	1/4 1 1/2	
L-0.4	C0.9			0 +50	106.60	R-107.76 L-106.43	-1.8 +0.2	+0.1	R-27.0 L-24.1	25.4 24.0	1.6 0.1	1/4 1 1/2	Clay Soil
L-0.0	C-1.2			0 + 00	106.10	R-108.36 L-106.22	-2.3 -0.1	0.0	R-28.0 L-24.2	27.5 23.6	0.5 0.6	1/2 1 1/2	

FIGURE 1—PART OF PAGE OF GRADE BOOK.



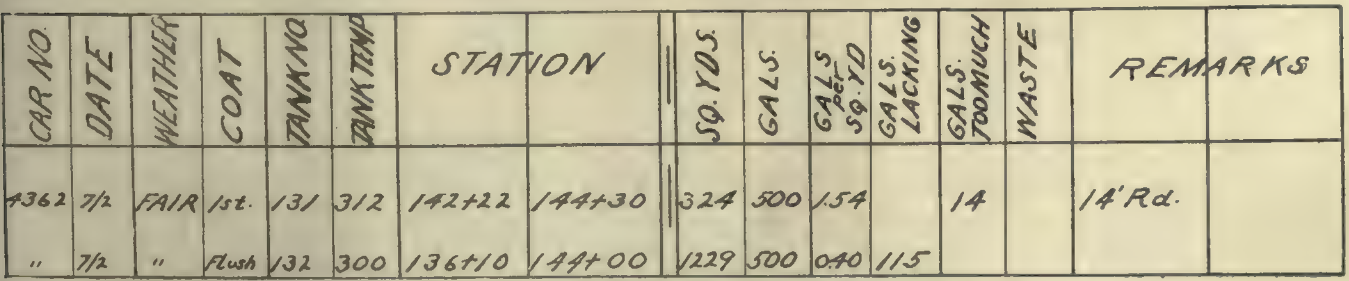
Station	Kind	Concrete 2nd Class	Concrete 3rd Class	Size	Metal Lbs.	Cement Used	Date Finished	Date Opened	Page of Details	Est. No.–Page Conc + Metal	Est. No.–Page Ex + Backfill	Est. No.–Page C.I.P.	C.I. Pipe Tons	Progress	Remarks
2+90	C.I.P.	33.2		31 X 16"		7 bgs	6/1	6/2	22	5-6	5-5	5-6	1.625	xxxx	
12+21	Con.	297.4	73.6	30' X 2' X 2'	73	53	6/9	6/17	23	5-7	5-7			xxxxx	

FIGURE 2—PART OF PAGE OF CULVERT BOOK.



STATION	FOUNDATION WIDTH	DEPTH = 0.5' L	C	R	Av D	BOTTOM WIDTH	DEPTH = 0.25' L	C	R	Av D	TOP WIDTH	DEPTH = 0.25' L	C	R	Av D	Av W	Av D TOT = 1.0'	DATE
	16'																	
0 + 00	159	49	50	52		15.9	23	22	24		15.9	23	24	25				F-7/10
0 + 50	16.0	51	52	48		15.9	24	25	23		15.8	26	25	23				
1 + 00	16.1	52	50	51		16.0	25	22	23		16.0	25	23	26				B-7/15
1 + 50	15.9	48	49	51		15.8	24	23	26		15.8	27	25	24				
2 + 00	16.0	49	51	52		15.9	23	24	27		15.8	26	24	22				F-7/20
	79.9	249	252	254		79.5	119	116	123		79.3	127	121	120				
		50	50	51			24	23	25			25	24	24				
	16.0				50+	15.9				24	15.9				24+	15.9+	98+	

FIGURE 3—PART OF PAGE OF STONE COURSE BOOK.



CAR NO.	DATE	WEATHER	COAT	TANK NO.	TANK TEMP	STATION		SQ. YDS.	GALS.	GALS. per SQ. YD.	GALS. LACKING	GALS. TOO MUCH	WASTE	REMARKS	
4362	7/2	FAIR	1st.	131	312	142+22	144+30	324	500	1.54		14		14' Rd.	
"	7/2	"	Flush	132	300	136+10	144+00	1229	500	0.40	115				

FIGURE 4—PART OF PAGE OF BITUMINOUS MATERIAL BOOK.

Engineer in Charge Book

The construction engineer is provided with a field book containing summaries of all items entering into the construction of the highway. These include shipments of materials, sampling of materials, memoranda, orders to contractor, etc. All unimportant structures such as cobble gutter, sign posts, signs and guard railing, together with their field measurements, should appear in this book.

The engineer in charge will also keep a daily record giving a complete history of the construction of the highway.

The recording, copying and computing of the data contained in this set of books is not as laborious as it may appear. In compiling these data the engineers obtain a thorough knowledge of the plans which alone would justify the labor. The inspectors, by virtue of having written records to keep, are stimulated to do better work, and at the same time a check is obtained on their diligence. In addition a complete set of construction books, carefully planned and kept, gives the engineers a grasp of the job that can result only in better work.

It is not presumed that this system of books will be accepted as the last word in construction book design. The object is to standardize construction records. This object can best be attained through a discussion of the subject by construction engineers. The above article, it is hoped, will stimulate such a discussion.

Oil Treatment for Highways[*]

By W. R. FARRINGTON[†]

In considering "oil treatment for highways," it is assumed that, while the treatment of broken stone and gravel surfaces is most important, some mention of dirt roads should be made.

The treatment of city streets, where the use of the road oils is confined principally to dust laying alone, will not be considered, but rather work of the ordinary town, county or state highways.

The equipment required for oiling work depends, of course, on the amount and kind of work to be done, the length of haul for the oil and other materials used, etc. Generally, however, the following will be required, if the town or department is to do all of the work with its own gangs and equipment:

One or two distributor carts, with proper distributors.

One heating boiler (if any but the lightest oils are to be used).

One steam or gas engine pump (for transferring the oil from the tank cars to the carts).

One mounted tool box or small portable tool house.

One steam roller and water cart (if extensive repairs are to be made to the road surface), and a straight toothed and curved spring tooth harrow, if the old surface is to be broken up and reshaped.

While there may be a difference of opinion as to the advisability of a town or department doing road construction or reconstruction with its own gangs, rather than by contract, it is probable that the nature of oiling work is such that the best results are obtained by doing the work (except possibly the transportation and distribution of the oil) at cost.

Unless a town or department uses a large amount of bituminous materials, it may be advisable to arrange with some oil company or contractor to deliver and distribute the oil, using motor trucks. However, such an arrangement may mean delay, as the oil companies are usually very busy during the season when most of the oil is applied, and delay is, of course, objectionable if it means allowing the surface to disintegrate or applying the oil after the travel is heavy. On this account it is probably advisable for a town or department to have sufficient equipment to do all of the work. On the other hand, the oil company will probably apply the oil at a somewhat less cost and do the work more rapidly.

If the oil is handled in horse-drawn carts, at least two carts should be used if the haul is long. On oiling work, perhaps even more than other road work, any apparently unnecessary delay is much resented by the users of the road. In construction or reconstruction, the traveling public seems to understand that some inconvenience is to be expected, but it is difficult to make people understand the necessity of doing oiling work during the season when they want to use the road.

In this connection it seems well to call attention to the advisability of putting up a sufficient number of proper detour signs (if the travel can be diverted) so anyone not familiar with the locality can find his way without trouble. Any considerable amount of travel over the sections of road being treated means poorer results and increased cost; more general attention to the erection of suitable detour signs means less criticism of the work, fewer vehicles passing over the road and less inconvenience, not only to the traveling public, but also to those doing the work.

If a motor-driven distributor is not used, a cart with pump distributor mounted on the frame back of the tank and operated by a chain and large sprocket bolted to one of the rear wheels will probably be most satisfactory, except possibly with very heavy oil where either a separate pump distributor operated by steam or a direct steam pressure distributor can be used to good advantage, although to operate either, a steam roller is required.

The oil should be shipped and heated in tank cars, but it is advisable to have the distributor carts equipped with steam coils or oil burners so that heating can be done in the carts, if necessary. The oil burners are, on the whole, most convenient, but an outfit with oil burners costs quite a little more.

While oils having a viscosity of not over 40 or 50 seconds, Lawrence Viscosimeter at 100° C.,[*] can be distributed without heating, even the heavier so-called cold oils require some heating—hence the necessity of a heating boiler. The boiler should be of at least 15 HP. for light oils and 25 HP. for heavy oils.

The mounted tool box or small tool house will probably pay for itself in a short time in the better condition of the tools and in the saving of tools which would otherwise be lost.

A steam roller is useful in patching and is necessary if the surface is to be broken up and reshaped. In this case a heavy scarifier is also useful, but good work can be done with the roller picks and suitable harrows. Relative to the latter, the speaker believes that both a straight tooth and a curved spring tooth harrow should be used. The former completes the breaking up of the surface, partially accomplished by the roller picks, and also tends to shake the fine material to the bottom, while the latter, because of the shape of the teeth, actually brings the stone or larger particles of road metal to the top.

Treatment of Dirt Roads

If a dirt road is to be treated with oil, the surface should be shaped with a suitable scraper and any depressions filled.

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[*] Paper presented at the road congress held at Worcester, Mass.

[†] Division Engineer, Massachusetts Highway Commission.

[*] 100 seconds with the Lawrence Viscosimeter at 100° C equals approximately 173 seconds with the 100-CC Engler Viscosimeter at 100° C.

On such roads a non-asphaltic oil will give good results and is possibly most economical if it is desired only to lay dust and prevent loss of the material through pulverization under the travel and subsequent blowing away. On the other hand, by using a light asphaltic oil with a viscosity of not over 40 seconds for the first treatment and heavier oils for future treatments, it is possible to form an oil crust which will carry the travel during the season. Such a surface may break up under frost action but, even so, a considerable part of the oil usually comes back on the surface after the road is shaped in the spring, so that less oil is required for retreatment after the crust is once formed.

Only a very light oil should be used at first, as otherwise there will be no bond between the road surface and the oil crust, which will break up under the travel. A 1/6-gal. treatment per sq. yd. will lay the dust on such a road but will probably be effective for only a month or two. From ⅜ to ½ gal. per sq. yd. for the first treatment will probably carry the road through the season and less amounts will be required after a year or two.

Oil Treatment on Broken Stone Surfaces

Before the oil is applied on broken stone surfaces, whether it is the first treatment or a retreatment, the surface should be thoroughly cleaned and patched, unless so badly out of shape that patching will not put it in reasonably good condition, in which case the surface should be broken up and reshaped. The best methods of patching the surface will be considered under the general heading of "patching." Relative to reshaping: While a blanket or carpet consisting of grit and suitable oil or tar will carry ordinary travel and relieve the road metal of much of the wear, such a surface cannot be considered a permanent form of treatment. As a result of the gradual wear of the road metal (and it is coming to be generally understood that even with a bituminous blanket there is, under heavy travel, an internal working of the road metal resulting in wear) and because repeated treatment and patching will result in the formation of bunches and an uneven surface, reshaping or resurfacing of the roadway will be necessary eventually.

When the time comes that the old surface must be broken up and it is intended to use the old road metal for the new surface, the speaker believes that if there is sufficient money available, a bituminous pavement should be formed, presumably by the penetration method, unless it is necessary to add a considerable amount of new stone, in which case mixing the stone and bituminous material for the wearing surface can be considered.

While a water bound macadam surface with an oil blanket may have carried the travel in the past, the travel may increase or the conditions change. Also, while in some cases excellent results have been obtained by simply reshaping and reoiling an old surface, in other cases failure has resulted, due presumably to the breaking of the old crust which has become very thoroughly knit together under travel, and the impossibility of obtaining as thorough a bond after reshaping, even if the road is properly rolled.

If, because of financial conditions, it is necessary to give considerable weight to the first cost of the work rather than to the eventual economy alone, the speaker believes that reshaping and reoiling are all right, provided the foundation is good and there is considerable stone left.

If the surface is reshaped, it should be thoroughly broken up and harrowed so as to insure having clean stone on top. Usually a little new stone must be added to secure the proper shape and crown. If much new stone is used, the voids should be partially filled with sand, stone screenings, etc., but otherwise there will usually be sufficient fine material in the stone to bond it. The stone should be thoroughly rolled and, if dry, should be watered during the rolling. While on such work there should be sufficient fine material to bond the stone, there must be no surplus, as it is essential that the stone on the surface be exposed and reasonably clean when the oil is applied; and it is difficult, if there is too much binding material, to thoroughly clean the surface under such conditions without disturbing the bond of the stone.

Either the heavier grades of so-called cold oils having a viscosity of from 100 to 200 seconds, Lawrence Viscosimeter at 100° C., or the hot oils with a viscosity of 500 or 600 seconds can be used, but the latter will probably give the best results.

About ½ gal. of oil per sq. yd. is required. It should be put on in two applications with a covering of grit after each application, and the surface should be rolled with a steam roller.

The cost of breaking up and reshaping an old macadam surface not previously treated with bituminous material will be 2 or 3 cts. per sq. yd., not including new stone. If previously treated, the cost may reach 5 cts. The cost of the oil work at last season's prices for oil should be not over 6 cts. per sq. yd., making the total cost of breaking up, reshaping and oiling or reoiling from 8 to 11 cts. per sq. yd.

If the road is not reshaped, the surface should be thoroughly cleaned before the oil is applied. A horse sweeper should be used, but on a surface not previously treated with bituminous material some sweeping by hand will probably be necessary, and if there is a considerable amount of worn-out material this may have to be removed with a road machine, or even by the use of hoes, etc.

For the first treatment, about ½ gal. of oil should be used per square yard, and it should be put on in two applications. The sand or other covering material should be stacked on the side of the road before the oiling work is started, to avoid delay in covering. It is usually advisable to oil only half the road at a time. This is more convenient for travel which has to use the road and also means that teams used on the work will not have to drive over the oil before it is properly covered.

If the surface of a road not previously treated with bituminous material is very dry, it should be watered before the oil is applied.

On the state highway work we have used practically all grades of road oils, from a cold oil with a viscosity of about 40 seconds, Lawrence Viscosimeter at 100° C., to hot oils having a viscosity of 1,700 to 1,800 seconds, but probably for blanket work, even if the road is scarified, oil with a viscosity of over 600 seconds should not be used, generally. The speaker believes that the best results are obtained by using, the first season, about ½ gal. per sq. yd. of an oil having a viscosity of about 50 seconds, Lawrence Viscosimeter at 100° C. The second season, about ⅜ gal. of oil with a viscosity of 100 seconds should be used, and the third season about ¼ gal. of oil with a viscosity of from 100 to 200 seconds. After the third season, not over 1/6 gal. per sq. yd. should be required for retreatment and it may not be necessary to treat each year, although this will probably mean increased cost of patching which may equal the cost of a 1/6-gal. treatment. Continued treatment with the heaviest grades of the so-called cold oils with a viscosity ranging as high as 200 seconds is probably advisable, although after a blanket has been formed which is thoroughly bonded to the road metal hot oil with a viscosity of at least 600 seconds can be used. If used, about ¼ gal. should be applied. Less than this probably will not thoroughly cover the surface and the use of a larger quantity means eventual bunching.

For some years, on the state highway work, we used hot oils with a viscosity of from 200 to 700 or 800 seconds, for the first treatment, as well as for retreatment, and a few of these hot oil surfaces are still in existence after five or six years. However, we found that with this grade of oil it was difficult to make the blanket stick to a new water bound macadam surface and that rolling and bunching were almost inevitable after, possibly, three years.

Eventually, because of the uneven surface (caused by rolling and bunching) many of the roads had to be broken up and reshaped or resurfaced. With the lighter oils there is not as much tendency to roll and bunch, and if, because of poor patching, etc., the surface does become uneven, this condition can be improved much easier by scraping with a road machine, or otherwise, than with heavy oil. The cost of a 1/6-gal. treatment with fairly heavy cold oil was last season about 1⅜ cts. per sq. yd.; of a ¼-gal. treatment, 2½ cts.; of a ⅜-gal. treatment, 3½ cts., and of a ½-gal. treatment, 5 cts. per sq. yd. A ¼-gal. treatment of hot oil cost about 3 cts. per sq. yd.

The amount of traffic oil blankets will carry depends on the proportion of horse-drawn vehicles, the local conditions, etc. An oil blanket which is safisfactory under ordinary conditions, even standing up well under frost action, may emulsify during a continued wet period in the late summer or early fall. It is evident that neither a hot nor cold oil blanket will stand up under a heavy traffic if there is a large proportion of horse-drawn vehicles. Both blankets have been badly cut up by the passage of a troop of cavalry or a large number of transport wagons during army manoeuvers.

That other conditions than the travel alone affect the results is evidenced by the fact that in one case both hot and cold oil blankets on a state highway failed under a traffic averaging daily as follows:

During August—
51 light horse-drawn vehicles;
123 heavy horse-drawn vehicles;
198 autos of all kinds;
16 trucks;
making a total of 388.

During October—
48 light horse-drawn vehicles;
153 heavy horse-drawn vehicles;
164 autos;
31 trucks;
making a total of 396.

Whereas, in another case, a road with a hot oil blanket applied in 1910 is still in fairly good condition, although the road carries the following daily averages:

In August—
484 light horse-drawn vehicles;
459 heavy horse-drawn vehicles;
1,435 autos;
84 trucks;
making a total of 2,462.

In October—
191 light horse-drawn vehicles;
196 heavy horse-drawn vehicles;
397 autos;
44 trucks;
making a total of 828.

It is probable that under ordinary conditions a suitable light oil blanket will carry rather more horse-drawn traffic than a heavy oil blanket, but presumably it is not advisable to depend on any kind of oil blanket if there are more than 150 or 200 horse-drawn vehicles a day, unless there is a large proportion of automobile traffic.

The treatment of gravel surfaces does not differ much from the work on broken stone surfaces, except in the preparation of the surface for the oil. Usually not much cleaning can be done on a gravel road, and it is therefore especially important that a light oil be used for the first treatment. Heavier grades, eventually about as heavy as on macadam, can be used for subsequent treatment. One-half gallon of oil is usually sufficient the first season, but it may be necessary to use from ⅜ to ½ gal. each year for several years. However, if the foundation is good and suitable gravel used on the road, after two or three years not much more oil should be required for retreatment than on macadam.

In preparing the surface for the oil, considerable expense can be saved if the road is properly shaped with a road machine after the frost has come out in the spring and the ground has dried somewhat, but the road is still soft enough to scrape easily. If necessary to shape when hard, the surface should first be thoroughly scarified or broken up with the roller picks and harrowed, then shaped with a road machine and watered and rolled with a steam roller. If there are slight depressions, these can be filled with mixed oil and sand, gravel or pea stone.

Patching

For patching, only a small gang is needed and the equipment required is simple. There should be one or two portable melting kettles, a mounted tool box or small portable tool house, and if the work is located at some distance from the homes of the laborers tents or a van in which the laborers can live should be furnished.

While the lighter grades of road oils or tars can be used without heating, oils having a viscosity higher than 50 or 60 seconds, Lawrence Viscosimeter at 100° C., give better results if heated slightly. Heavier grades must be heated to obtain good results. It is also much more convenient to handle the oil or tar in kettles than in the barrels. There are some fairly heavy cold patching compounds on the market, which do not require any heating and give excellent results, but these usually cost quite a little more than the road oils, and the speaker questions whether, ordinarily, the results warrant the additional cost.

For ordinary patching, the small mounted kettles of from 60 to 120 gals. capacity are most satisfactory. For making large patches or for recoating short sections of road, which work might be classified as patching, a kettle of about 300 gals. capacity with a hand-operated pump sprayer is very convenient. With the kettle the speaker has in mind, the pump is mounted on the kettle and jacketed, the jacket being connected with the firebox of the kettle, the heat from which keeps the pump warm and prevents clogging. This combination of kettle and sprayer does good work and is economical on small jobs.

The methods to be followed in patching the different kinds of oil or tar surfaces are much the same. Usually the same kind of bituminous material should be used for patching as was used in forming the surface, although with broken stone or any large aggregate it is sometimes more convenient to use tar than oil for filling depressions, even with an oil blanket. Ordinarily, it is not advisable to use a much heavier grade of bituminous material for patching than was used on the surface—except with stone, slag or chips, for filling deep depressions—and in patching a heavy oil blanket, usually a lighter oil is advisable.

For most oil surfaces, an oil with a viscosity of about 50 seconds, Lawrence Viscosimeter at 100° C., should be used for patching in the early spring and late fall, and during the remainder of the season oils having a viscosity of from 100 to 200 seconds will probably give the best results, except with stone or other large aggregate for filling deep depressions, where ordinarily a heavier oil or tar should be used.

In filling depressions, the best results are obtained by mixing the bituminous material and sand or stone, etc., before applying, but satisfactory results can be obtained without mixing, if the work is carefully done. In filling slight depressions, where the materials are not mixed before applying, a thin coating of oil or tar is spread over the bottom of the depression and covered with sand, gravel, or pea stone. Not over ½ gal. of bituminous material should be used per sq. yd. with sand alone, as more than this will probably result eventually in rolling of the surface and the formation of bunches.

If stone or other large aggregate is used, the bottom of the depression is coated with oil or tar, and after the aggregate is put on, more bituminous material is spread over it and covered with grit.

If the materials are mixed before applying, 18 to 20 gals. of oil or tar should be used per cu. yd. of aggregate.

In filling depressions, it is usually advisable to cut out the edges so as to be sure of having a thorough bond between the old and new materials.

In filling depressions with large aggregate, if a roller is not available, the material should be thoroughly tamped and the use of a hot asphalt smoothing iron is advisable. This tool seals the surface and checks the tendency to swell and form bunches, if a slight excess of bituminous material is used.

In considering patching, some mention should be made of the work of removing bunches, for whatever care is used in oiling or patching, more or less bunching is to be expected eventually. If there are not many bunches they can be cut off with a hot shovel or special tool formed of a heavy ice cutter, etc. If badly out of shape, the use of a road machine will give good results, under favorable conditions. The work should be done immediately after a rain, during the very warm weather, as both heat and moisture are needed to so soften the bituminous material that it can be scraped easily. Sometimes it is possible to simply cut off the surplus material, but usually it is necessary to cut down to the road metal, in which case the sections where bunches have been removed must be resealed.

Just a word as to accounts: While the first consideration is good work, it is necessary to know what the cost of the work is, so as to decide what kind of work is most economical, and some system of accounts should be used which will enable those in charge to determine easily at any time the cost of the different kinds of work.

In mentioning equipment required for patching it was assumed that the use of motor trucks was not considered. At the same time the speaker believes that the time is fast approaching when trucks will be used extensively for patching and other repair work on the roads, and it seems probable that light trucks similar to those used by the telephone companies, etc., will be found economical for some classes of work.

The Construction of a Grouted Granite Block Pavement at Woonsocket, Rhode Island

By A. L. UPHAM

During the year 1915, the city of Woonsocket, R. I., paved four streets, Clinton, South Main, West School and Pond, with grouted granite block paving aggregating 27,000 sq. yds. at a cost of approximately $102,000. Work was commenced early in May and was completed (Clinton Street) on December 5.

The subgrade being first brought to shape and rolled until solid, a layer of No. 1 trap rock was spread to roll to a thickness of 5 ins. The roller used was a 6-ton tandem roller.

After a thorough wetting of the stone by sprinkling with a hose, the voids were filled with a cement grout in the proportions of 1:4. A Hassam grout mixer was used on this work and rendered excellent results. The surface was then thoroughly rolled and brought to an accurate cross section.

After allowing the concrete base to set for not less than 24 hours, a sand cushion 1½ to 2 ins. in thickness was spread. Upon this cushion were laid the granite blocks. The blocks used were New Hampshire granite 6 to 12 ins. in length, 3½ to 4½ ins. in width and 5 to 5½ ins. in depth.

No variation from a true plane greater than ⅜ in. was allowed in the wearing face of the blocks, and joints were not greater than ¾ in. in width. As the blocks were laid, they were stiffened by sprinkling pea stone lightly over the surface and brooming it into the joints. The blocks were then thoroughly rammed.

GROUTING STONE IN BASE COURSE—GRANITE BLOCK PAVEMENT AT WOONSOCKET, R. I.

The cement grout filler between the blocks was mixed in the Hassam grout mixer, in the proportion of 1:1 and of the consistency of thin cream. It was then poured upon the blocks and broomed into the joints. During this operation, pea stone was scattered in the grout as it was being poured.

After allowing this first application of grout to subside into the joints, another application was made, using grout of the same proportion but of the consistency of thick cream. This was spread evenly over the surface with wooden squeegees to fill all joints flush with the tops of the blocks.

When the surface had hardened sufficiently it was covered with ½ in. of sand and sprinkled daily for three or four days. No traffic was allowed on the pavement until the cement had set not less than six days.

The paving was laid by the Simpson Bros. Corporation of Boston, Mass., under the supervision of City Engineer Frank H. Mills, and the writer as inspector.

The British Road Board Appropriates $1,000,000 for Road Improvement

The Road Board of Great Britain recently advised county authorities of its intention as to grants for road crust improvements during the financial year of 1916-17. According to the official circular, new grants or loans amounting to a total of not over $1,000,000 may be made out of the surplus to the credit of the road improvement fund.

It is stated that the grants and loans will be devoted chiefly to tar treating improved roads. It has been brought to the notice of the Road Board by the Minister of Munitions that certain products obtained from the distillation of crude tar are of great importance in the manufacture of high explosives and for that reason the use of refined tar is urged upon highway authorities. It is also argued by the board that at the present time, when the greatest economy consistent with adequate maintenance is desirable a surface dressing of tar is the most economical and efficient means of preserving the roads, providing the surfaces are in proper condition to receive the treatment. It is stated that the board will have to be satisfied as to this point and that no grants will be made for the use of crude tar.

That a Gravel Road is Better Than an Oiled Earth Road was the consensus of opinion at the third annual road school and county engineers' convention held at Ames, Ia., in February, according to an article in the March issue of the "Service Bulletin" of the Iowa State Highway Commission. This conclusion is chiefly based, apparently, upon the observations of State Highway Engineer Gearhart of Kansas and Division Engineer R. L. Bell of the Illinois State Highway Commission. A brief description of the methods of building oiled earth roads in Kansas was printed in a note in "Good Roads" for Sept. 4, 1915.

An Important Quality of Wood For Paving Purposes[*]

By MAJ. W. W. CROSBY[†]

Not so many years ago it was a common practice in paving specifications to call for or describe some of the materials by their trade names, and, for the purpose of avoiding the creation of a monopoly or of an embarrassing situation by such a specification, to append to such a description the alternative clause "or other material equally good in the opinion of the engineer." Frequently, however, such an alternative created another situation equally embarrassing, and the indefiniteness and unscientific character of the clauses were generally recognized. Then the effort was made to determine and describe the essential characteristics of a material known by experience to be satisfactory for the purpose for which it was intended to be used, and by such description in the specifications, to insure the delivery of a material which, regardless of its name, would be sufficiently like the particular material in question to be satisfactory to the highway authority and the needs of the occasion. Such a course also seemed to offer a more rational method for the engineer, or other referee under the contract, to convince everyone of the equalities or inequalities of the materials offered.

Quite naturally, perhaps, engineers who had become accustomed to the use of a particular brand of material felt obliged, in abandoning the use of the brand as a means of description of the material desired, to be on the safe side in their substitution of a more technical description, and often they were assisted along the lines of this tendency by their chemical or other advisers, particularly when none of the parties could be positive as to just what elements entered into the production of certain facts, apparently considerable, in the use of the material for the specific purposes of paving.

For instance, take the case of bituminous materials: Up to six or seven years ago but few such materials were generally on the market; their characteristics were fairly well known, and their specification was usually by a trade name as at first described, according to the personal views and experiences of the engineer in charge of any particular case Quite suddenly there was a demand for similar materials differing in many respects from the common products referred to, and this demand was met by a prompt supply of greatly varying materials from both the older sources of supply and from newly developed ones. The accurate description of just what was wanted in any particular case was necessary, and the insufficiency as well as the impropriety of the older methods of description became evident. Thereupon, detailed descriptions of the various materials were put forth. Many of them were so complicated as to be objectionable for many reasons. The simplification of these complex descriptions, when attempted, was found sometimes to be difficult because of the lack of knowledge as to the effect that would be brought about by the omission or condensation of some of the clauses. There may often have been a resistance to simplification brought about by the desire to further research work and the accumulation of definite knowledge through the opportunity offered by such specifications.

Perhaps the first important instance of departure from the older form to a more rational form of specification for a material was in the case of hydraulic cement. Here, a relatively simple compound had to be described, and it was quickly settled that a few physical tests supplemented by one or two chemical ones was all that was necessary to insure the delivery of a proper article. There may still be some question as to the necessity for all the tests now commonly required on this material, but in the main its description seems to have been satisfactorily standardized.

The same general line of action appears to have been, or to be being, followed with many others of the paving materials in use. The main objects of this paper are to call attention to the lagging behind, in some respects at least, and as it appears to the writer, in the case of specifications of wood blocks for paving purposes, and to suggest for consideration and discussion among those interested the possibility of a considerable improvement in the now customary specifications for this material.

The specifications for wood blocks have generally, to date, prescribed that the material should be "long leaf yellow pine" (pinus palustrus) or other wood equal thereto, in the opinion of the engineer (with occasionally an alternate wood mentioned by name); that the growth rings should be in number between certain limits per inch; and that the blocks should be within a certain maximum limit of variation from size, percentage of knots, checks and other defects. It is, of course, also prescribed that they shall be treated with a preservative whose characteristics and use are described more or less carefully. But for the purpose of this paper, the discussion will be confined to the specifications referring to the description of the wood itself.

It seems to the writer that, exactly as in the cases of hydraulic cement and of bituminous materials, it is not only entirely possible to improve on these specifications for the wood to be used, but also that it is extremely desirable, for many reasons, that this should be done. He proposes to suggest one way in which he thinks the end may be reached.

The object of the old specifications, naming the wood to be used and describing limits for the variation of this particular wood, seems to have been to secure a grade of material which it was felt experience had demonstrated would be capable of proper impregnation by a preservative and when so impregnated by the preservative and laid in the roadway, would be neither too soft to wear objectionably nor too hard ordinarily to be slippery under traffic. Now, may not both of these ends be secured by a single specification which shall properly describe and place limits to a quality of wood, which, for want of a better term, the writer will call its consistency? Perhaps the term resiliency would be more accurate, but there may be some discussion on this point, and as authorities do not seem to be agreed as to a definition and measure of the resiliency of wood, the somewhat broader term—consistency—seems to the writer more satisfactory for the present.

The writer believes that an assumption may be made here to the effect that, under the same conditions as to preservative and treatment, the harder the wood the less of the presrvative absorbed, and vice versa; also, that hardness and softness are merely colloquial expressions for degrees of consistency, purely relative and by no means definite. Again, the writer thinks it will be generally agreed that an extremely hard wood paving block is likely to prove objectionably slippery in the roadway, while too soft a block does not show sufficient resistance to wear; not that a desirable block is one which will come, in consistency—that is, in hardness or softness of wood—somewhere between the limits of the hardest permissible without slipperiness and the softest permissible without excessive wear. It is, therefore, a measure of hardness or softness—that is, of consistency—which will determine the kind of wood to be permitted for use in any case. And if a means for measuring this consistency and a scale of consistency shall be adopted, there will then be no further need for naming the kind of wood to be used, and quite probably no need of going into detail in the specifications concerning the number of rings to the inch in the different kinds of wood. The resulting specifications will, therefore, be less subject to criticism on the grounds of containing too large a personal factor, of being too indefinite, or of being unnecessarily narrow and "closed," such as is the case when it is stated that another kind of wood than that specified will be accepted if "equal in the opinion of the engineer," or when a single kind of wood is specified, or when the count of rings is limited too narrowly.

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[*] Paper presented before Section D of the American Association for the Advancement of Science at the Columbus (Ohio) Meeting.

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Some attempts have been made along different lines toward establishing a measure of consistency. The U. S. Forest Service has done some research work and published some conclusions along this line. The Case School of Applied Science, Cleveland, Ohio, has also had some work done under its supervision along related lines.

The writer's opinion as to the general value of a consistency test on paving materials has been perhaps sufficiently set forth in his paper on "The Consistency of Bituminous Materials" printed in "Engineering and Contracting" for February 5, 1913, page 152, and in "The Surveyor" (London) for March 7, 1913, page 425, to need no repetition here. Those interested to secure it in detail may do so by referring to the publications just given. The writer would say that generally the remarks there may, he believes, apply equally well to wood when the necessary changes in substantives are made.

Considering now a consistency test for wood and referring to the above mentioned work of the U. S. Forest Service, it will be found that this bureau in its Circular 38 (revised), entitled "Instructions to Engineers of Timber Tests," refers on pages 22 and 23 to certain tests for compression, and again on page 24 to an impact test. The latter test is used to determine the relative brittleness of different woods. In a circular (No. 213) subsequently issued by the bureau on "The Mechanical Properties of Woods Grown in the United States" is given a table on the results of a number of tests, included in which is a test for hardness, and the figures given under the head of this test are stated to be those of the load in pounds, "required to embed a 0.444-in. ball to one-half its diameter." In the same table are also given figures for the results of the compression test and the impact test, which it should probably be stated now is the bending under impact and not the rebound of the impacting tool. None of these tests seems to the writer to measure directly the quality of the wood he has in mind—that is, its resiliency or consistency—though perhaps they all, more or less indirectly, throw some light on this quality, and the results of these tests may in some cases be more or less directly related to the results which would be secured from a more direct test of this quality. Under the impact test, and up to the point where permanent deflection takes place, it might be said that the resiliency of the wood—that is, the ability of the wood to return to its normal position after distortion, was indicated. But this ability in a beam may be quite different from the ability of a portion of the area of the wood to resist displacement or to return after displacement. With wood paving blocks, which seldom, if ever, are obliged to act as beams, it is the resiliency of a small area which is critical.

The hardness test is described by the Forest Service as the measurement of the force required to produce a definite amount of displacement of the wood fibers. This is not the critical feature in wood paving blocks. With them it is rather the ability to resist displacement or for the fibers to react and to return to their normal positions after a strain tending toward displacement has been undergone by them. Perhaps a slight modification of the hardness test described might answer the purpose. That is, if the steel ball (or a cube) should be loaded with a specific weight less than that required in any case to produce permanent displacement of the fibers, and the application of the force made for a definite period, the maximum displacement being measured at the end of that period while the force was still applied, and then the force removed and the amount of restoration, toward their original position, of the wood fibers measured by determining the difference in position of the ball or cube before and after the removal of the force, the end desired would be reached; and the elasticity, resiliency or consistency of the wood thus determined in a way which would throw considerable light on its suitability for use as a paving block.

The writer is not aware of how much research work along this line may have been done, but he hopes that it is considerably more than his knowledge at present covers. It is with a view to bringing out such information as is available along this line, as well as for perhaps suggesting an investigation of value in this connection, that he submits this paper.

Reference has been made to the desirability of securing a wood which would be capable of proper impregnation by a preservative, and it may seem that in the foregoing, too much consideration has been given to the consistency of the wood alone and this matter of impregnation has been neglected. When a satisfactory test for consistency shall be developed, the writer hopes that it will be found that the capacity of a wood to absorb the preservative is related to its consistency within the limits of the latter suitable for specification in the cases of wood pavements. He admits that the information on this point in his possession is incomplete at present. Whether or not, however, the fact hoped for shall be established need not interfere with the establishment of a proper test for the consistency because, this having been established, it will then at most only be necessary to supplement it with another determination as to the capability of the wood for absorbing the preservative.

Correspondence Course in Road Building Given by the University of Oklahoma

A correspondence course in road building is given by the Extension Division of the University of Oklahoma at Norman, Okla. The course consists of twenty-four lessons prepared by James Irwin Tucker, Professor of Civil Engineering at the university, and is sold for $11.70, plus the postage on the lessons.

The material for the course comprises six paper-bound pamphlets, each consisting of a series of treatises on various phases of road building and the lessons, which consist of questions based on the text. The scope of the text in the six pamphlets is shown by the various chapter headings, which are as follows: 1, General Status and Preliminary Studies; 2, Road Economics; 3, Road Administration; 4, Convicts and Road Work; 5, Earth Road Construction; 6, Cost Accounting and Earth Work; 7, Earth Road Maintenance; 8, Waterways; 9, Bridges; 10, Road Finance; 11, Stone Roads; 12, Gravel Roads; 13, Sand-Clay Roads; 15, Needed Legislation.

The course is sent out one pamphlet at a time, to those who desire to take it, and written replies to the questions in the lessons are sent in. The course is open to anyone who desires it, whether a resident of Oklahoma or not. Upon completion of the course, the material in the paper pamphlets is furnished in one cloth-bound volume for use as a reference book.

Director Tucker states that during the three months since the course was first offered, thirty students—mostly county surveyors and county engineers in Oklahoma—have enrolled and about one hundred and thirty lessons have been sent in. It is the belief of the university authorities that the course will yield more satisfactory results that could be secured by a short course of resident study, since the student has the subject-matter before him and can take time to digest the information instead of having to attempt to absorb a large amount of similar information in the comparatively short time available at a road school.

Reconstruction Exposition in Paris, France

An exhibition, designed as an aid in the reconstruction and restoration of the private and public works destroyed by the war, is to be held at Paris during May, June and July of this year. The object, as formally stated, is "the reconstruction of the destroyed towns and villages, the extension and the installation of towns and villages, aesthetics and hygiene of the city, the presentation of materials and methods of construction, the interior arrangement of dwelling houses, and legislation."

In a statement to American manufacturers it is pointed out that the war has destroyed the habitations of 35,000,000 people, the country roads, the city streets, the public service systems, factories and farms. The end of the war will mark the beginning of the work of reconstruction and for this there will be needed an enormous supply of materials and machinery. It is believed that the exhibition at this time will bring together the buyers and sellers of these materials and machines.

The exposition is divided into four groups. These are further subdivided as follows:

Group 1—Arrangement of Towns and Villages: Class 1, Reconstruction of Destroyed Towns and Villages; Class 2, Plans for the Extension and Arrangement of the Towns and Villages; Class 3, Public Thoroughfares and Promenades; Class 4, Appearance of the Town; Class 5, Improving the Sanitary Condition of the City.

Group 2—Public Edifices, Dwelling Houses, Rural and Industrial Constructions: Class 6, Public Edifices; Class 7, Dwellings; Class 8, Rural and Industrial Constructions.

Group 3—Materials for and Methods of Construction, Interior Arrangements of the Dwelling House: Class 9, Materials for and Methods of Construction; Class 10, Interior Installation of the Dwelling Place.

Group 4—Legislation, Principles and Application of Rural and Urban Economics: Class 11, Comparative Legislation and Regulations; Class 12, Means of Realization of Plans of Arrangement, Extension and Reconstruction of the Cities.

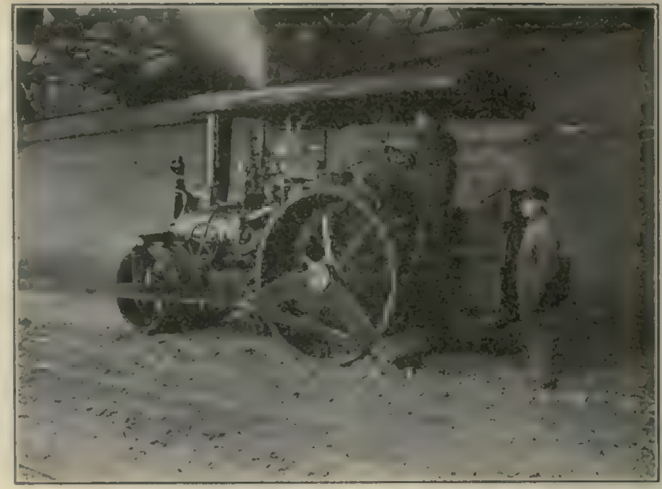
The American Section is under the direction of Henry C. Long, 16 Rue Taitbout, Paris.

Removing Ice From City Streets with a Scarifying Roller

A new use has been developed for steam rollers of the scarifier type by A. T. Rhodes, Street Commissioner of Worcester, Mass. The Street Department of that city acquired one of the first six Buffalo Pitts scarifiers which were produced by the Buffalo Steam Roller Co.

His city being situated in New England, he is greatly troubled at certain seasons of the year by accumulations of ice, particularly in and around the street railway locations. About the only method of removal is by hand picking, and that method is very costly.

The main difficulty encountered was in steering and in driving the machine on the hard frozen surface. The steering was accomplished by equipping the big scarifier roller with the front wheel of a 10-ton roller, on a shaft to fit it. Around each half of the 10-ton roller wheel are shrunk two T irons of about ⅝ in. thickness. These bite into the ice, giving steering traction for the front wheel of the steam roller. Driving traction has been secured by stub picks in the large wheels, but Commissioner Rhodes is planning to substitute cleats fastened to the driving wheels by bolts through the pick holes. These, he is convinced, will be a great improvement over the stub picks.



ROLLER WITH SCARIFIER BREAKING UP ICE ON A STREET IN WORCESTER, MASS.

The machine is doing good service and will cut through any usual depth of ice accumulation on a city street, with ease, doing the work of many men and furnishing work for the machine at a time of year when it would be idle.

Methods of Marking Main Roads in New Hampshire

For the purpose of facilitating travel over the main roads of New Hampshire, the State Highway Department has adopted the scheme of marking posts or poles along the roadside with various colored bands. Where one color is used to designate the road the band is 12 ins. wide with a 2-in. border band, and where two colors are used each band is 6 ins. wide and a border band is used as with the wider, single band. This work was started in 1913 and has since been completed.

The three main roads of the state are the West Side Road, the Merrimack Valley Road and the East Side Road. The West Side Road extends from the Massachusetts state line, near the western border of New Hampshire, northerly along the west side of the state; the Merrimack Valley Road, from the Massachusetts line at Nashua, northerly through the central part of the state, and the East Side Road, from the Massachusetts line near the coast, northerly along the eastern side of the state. The West Side Road is marked by a blue band with a white border, the Merrimack Road by a green band with a white border and the East Side Road by a yellow band with a black border. Other roads are marked as follows:

South Side Road, brown band, white border; Meredith-Ossippee Road, red band, white border; Crawford Notch Road, double red band, white border; Central Road, white band, black border; Sunapee Lake Road, black band, white border; Moosilauke Road, white band, red border; Mascoma Valley Road, green and blue bands, white border; Winnipesaukee Road, gray band, black border; Contoocook Valley Road, gray band, white border; Gorham Hill Road, blue and yellow bands, white and black borders; Franconia Road, orange band, black border; Suncook Valley Road, green and yellow bands, white and black borders; Monadnock Road, orange band, black border; Hudson-Derry Road, green and orange bands, white border; Raymond-Plaistow Road, black band, white border; Rockingham Road, orange band, white border.

AMERICAN ROAD BUILDERS' ASSOCIATION

150 NASSAU STREET
NEW YORK, N. Y.

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Through the courtesy of the publisher of "Good Roads,' this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

A. R. B. A. Members at the Canadian Good Roads Congress

Prominent parts in the proceedings of the Third Canadian and International Good Roads Congress, held at Montreal, P. Q., early in March, were taken by members of the American Road Builders' Association.

Among those taking part were Third Vice President Wm. H. Connell, Chief of the Bureau of Highways and Street Cleaning of Philadelphia, Pa.; J. A. Sanderson, Honorary President, Ontario Good Roads Association; Gabriel Henry, Chief Engineer, Department of Highways, Province of Quebec; Edward Fafard, Superintendent of Government Machinery, Province of Quebec; Col. Wm. D. Sohier, Chairman, Massachusetts Highway Commission, and Arthur H. Blanchard, Professor of Highway Engineering, Columbia University.

A. R. B. A. Notes

John T. Gephart, Jr., has resigned as Assistant Engineer in the Pennsylvania State Highway Department.

Alfred Clark, Superintendent of Streets, Concord, N. H., has been elected Second Vice President of the New Hampshire Good Roads Association.

A. D. Williams, Chief Road Engineer of West Virginia, was one of the speakers at the recent West Tennessee Good Roads Conference at Jackson, Tenn.

S. E. Bradt, Secretary of the Illinois State Highway Commission, was one of the speakers at a recent open meeting of the Springfield Engineers' Club, held at Springfield, Illinois.

O. F. Winslow, Superintendent of Streets, Nashua, N. H., was elected President of the New Hampshire Good Roads Association at a recent meeting at which the association was organized.

Third Vice President William H. Connell, Chief of the Philadelphia Bureau of Highways and Street Cleaning, presented a paper entitled "Modern Methods of Snow Removal" at the Conference on Snow Removal, held at the Automobile Club of America, New York, N. Y., on the evening of March 8.

James C. Travilla, Consulting Engineer, Fort Worth, Tex., who was formerly Street Commissioner of St. Louis, Mo., has been mentioned as likely to be appointed by the County Court of St. Louis County as one of the engineers who will direct the expenditure of the $3,000,000 bond issue recently voted in that county for road and bridge work.

A. N. Johnson, formerly State Highway Engineer of Illinois, has resigned his position with the Bureau of Municipal Research, New York, N. Y., to become Consulting Highway Engineer for the Portland Cement Association. As was noted in a recent issue of "Good Roads," Mr. Johnson, before becoming State Highway Engineer of Illinois, was Third Assistant Engineer of the Massachusetts Highway Commission, State Highway Engineer of Maryland and Chief Engineer of the U. S. Office of Public Roads and Rural Engineering. Mr. Johnson's headquarters will be at 111 West Washington Street, Chicago, Ill.

NEWS NOTES

The Board of Public Works of Seattle, Wash., has awarded a contract for a $303,000 bridge. Bids will be opened on March 31 for bonds to pay for this work.

The Greater Des Moines Committee, Des Moines, Ia., has offered to pay the cost of loading gravel for any community in Polk County, Ia., where the cost of hauling is provided for.

A Plan to Build a Street Parallel to Main Street, Rochester, N. Y., has been abandoned for the time being at least, owing to the expense. It is estimated that the improvement would cost about $3,000,000

Smooth Track Crossings Have Been Secured in Cedar Rapids, Ia., according to reports, by the use of reinforced concrete slabs laid between the rails. Two slabs are used at each crossing, their thickness being equal to the depth of rail. They are cast at the city yard and are laid on top of the ties and held in place by stakes at the ends or by timbers spiked to the ties. It is stated that crossings of this type have given satisfactory results and that the slabs give every indication of sufficient durability.

The Boulevard Around Twin Peaks, San Francisco, Cal., is to be opened about April 15, according to a recent report. Though only about a mile in length, this road will be one of the most interesting of the numerous boulevards in and near the city, as it will command a magnificent view. The boulevard will be paved to a width of 25 ft. with sheet asphalt on a concrete base. A somewhat detailed description of San Francisco's boulevard system was printed in a previous issue of "Good Roads." ["San Francisco, the Exposition City," "Good Roads," Sept. 4, 1915, page 133.]

COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

NEW PUBLICATION

GOOD ROADS BULLETIN FOR ILLINOIS PUBLIC SCHOOLS; Edited by James H. Green and Ira O. Baker, Members of the Faculty of the University of Illinois; Issued by Francis G. Blair, State Superintendent of Public Instruction.—Paper; 6x9 ins., 32 pp. and covers; illustrated.

This bulletin was prepared particularly for use by teachers in the public schools on the last Friday of March, which was designated as "Good Roads Day." Its contents include a chapter comprising suggestions for using the bulletin, written by Mr. Green; a portion of a speech entitled "Good Roads and Good Schools" by Assemblyman Homer J. Tice, author of the Tice law; a chapter entitled "Pertinent Points About Roads," by Professor Baker; a chapter entitled "Construction and Maintenance of Earth Roads," by H. E. Bilger, Road Engineer of the Illinois State Highway Department, and a chapter entitled "Roadside Improvement," by I. D. Allison, Associate in Landscape Extension, College of Agriculture, University of Illinois. The illustrations consist of halftones showing improved and unimproved roads and reproductions of drawings of road drags, cross sections of roadways, etc.

STATE OF NEW HAMPSHIRE, HIGHWAY DEPARTMENT, PATROLMAN'S HANDBOOK.—Paper; 5x7 ins., 32 pp. and cover.

This publication of the New Hampshire State Highway Department is designed for the guidance of the state road patrolmen, and includes in its contents complete directions for the performance of the work which these men are called upon to do. Separate sections are devoted to the matters of weekly reports, payment for work and buying supplies, accident reports, town roads and bridges, drainage, dragging and carting, and various other parts of the patrolman's work. There is also included a section giving information as to the trunk lines and the methods of designating them by colored bands on telegraph poles. The book is illustrated by a reproduction of a form for patrolmen's reports and by sketches of road drags.

APPARATUS FOR MEASURING THE WEAR OF CONCRETE ROADS. By A. T. Goldbeck; Reprint from the "Journal of Agricultural Research," Department of Agriculture.—Paper; 7x10½ ins., 10 pp. and covers; illustrated.

RELATION BETWEEN PROPERTIES OF HARDNESS AND TOUGHNESS OF ROAD BUILDING ROCK. By Prevost Hubbard and F. H. Jackson, Jr.; Reprint from the "Journal of Agricultural Research," Department of Agriculture.—Paper; 7x10½ ins., 6 pp. and covers.

EFFECT OF CONTROLLABLE VARIABLES UPON THE PENETRATION TEST FOR ASPHALTS AND ASPHALT CEMENTS. By Prevost Hubbard and F. P. Pritchard; Reprint from the "Journal of Agricultural Research," Department of Agriculture.—Paper; 7x10½ ins., 14 pp. and covers.

These three reprints consist of technical papers on the subjects noted. They are of uniform size and binding and have been issued at different times during the past few weeks. The authors are all connected with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture. Prevost Hubbard is Chemical Engineer; F. H. Jackson, Jr., is Assistant Testing Engineer; A. T. Goldbeck is Engineer of Tests, and F. P. Pritchard is Assistant Chemist.

REPORTS

MASSACHUSETTS, CONCORD; Annual Report of the Road Commissioners for the year ending December 31, 1915.—Paper; 6x9 ins., 45 pp.

This report consists of two parts, the first comprising the report of the Road Commissioners and the second the report to the Road Commissioners made by the Superintendent of Roads and Streets. The first part consists of a general review of the work, with recommendations for future work and with especial reference to financial arrangements. The second part comprises detailed data on the work done. Much of this latter information is shown by tabular statements of expenditures, work done, etc.

NEW JERSEY, CAMDEN; Report of the City Highway Department for the year ending December 31, 1915.—Paper; 6x9 ins., 62 pp. and covers; illustrated.

Included in this is the report of the Street Commissioner and considerable miscellaneous data relative to the city streets. The statistics included are presented, for the most part, in the form of tables showing details of the work. There are also included specifications and a street guide of the city. The illustrations comprise reproductions of portraits of the city Street Committee, the Street Commissioner and Assistant Street Commissioner, and views of improved and unimproved streets, street work under construction, the city asphalt plant and the city workhousue.

PERSONAL NOTES

G. C. Peterson has been elected Highway Commissioner of Sheboygan County, Wis.

George M. Randall, a contractor, and formerly Road Commissioner of Freeport, N. Y., died recently at his home in that place.

E. G. Campbell, Pomeroy, O., has been appointed Engineering Superintendent for the Ohio State Highway Department.

William H. Becker has been engaged as Consulting Engineer by the Gila County, Ariz., Road Department. He will supervise road construction to cost $350,000.

Charles S. Pope has been appointed Engineer for Warren Bros. Co., Oakland, Cal. Previously he was attached to the staff of the City Engineer, Los Angeles, Cal.

R. E. Harrison, Assistant City Engineer, Grand Rapids, Mich., has resigned to become Vice President and Manager of the L. A. Boulay Co., civil and sanitary engineers, Toledo, O.

A. L. Stewart has resigned as Manager of the Rushville Furniture Co., Rushville, Ind., and will resume engineering and contracting in which he was engaged prior to his connection with the furniture concern. He will specialize on road and bridge work.

Doddridge County, West Virginia, is planning to spend $440,000 for paving in three districts.

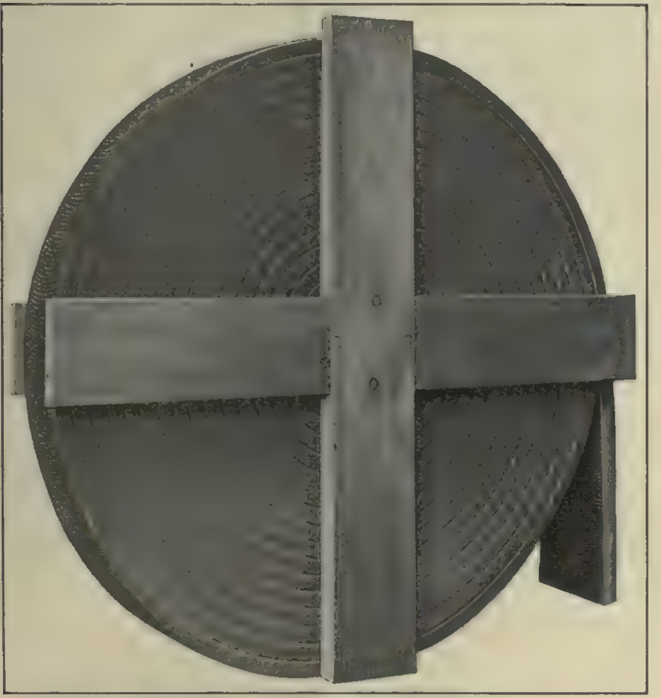
Douglas County, Nebraska, will have an election April 18 on a bond issue of $1,700,000 for the purpose of building roads.

Yellowstone County, Montana, plans to build 47 miles of road with proceeds of a recently voted bond issue of $175,000.

EQUIPMENT — TRADE — MATERIALS

New Expansion Joint

A new material for the expansion joints of concrete or block pavements is shown in the accompanying illustration.



BARRETT'S EXPANSION JOINT.

The material is a mastic which comes in the form of a ribbon in a variety of widths and thicknesses. It is sold in rolls, as shown in the illustration, and is ready to lay. It is made by a new process known as the "fiber weld" process, which, it is stated, gives to the bituminous mastic the requisite cohesiveness to stand handling and storage without affecting the elasticity that is necessary in an expansion joint material.

The chief claim made for the material is that it eliminates the necessity of heating and pouring apparatus and can consequently be laid at a low cost. It is also claimed that it is waterproof and weatherproof, that it is not injured by street acids or automobile oils, and that it does not become brittle with age or cold weather and does not soften or run in hot weather.

The joint is made by the Barrett Company, of New York, N. Y., and is to be marketed under the name of Barrett's Expansion Joint.

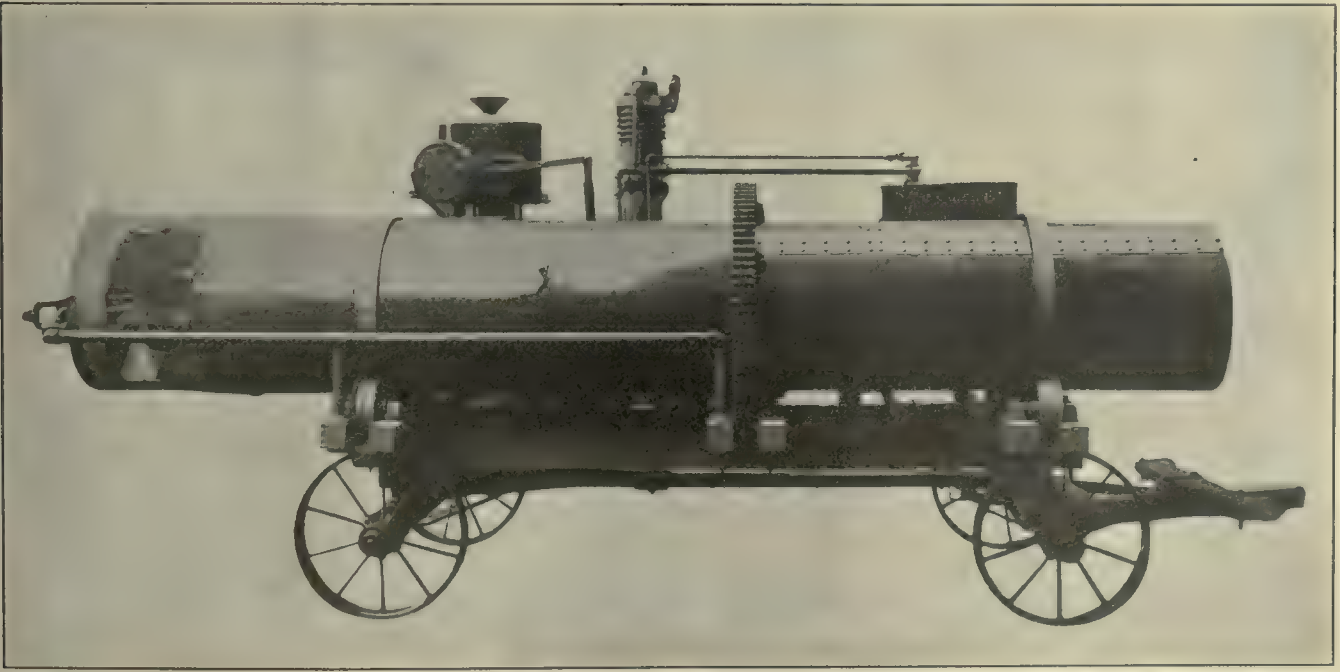
New Portable Sand and Stone Drier

To meet the demand for a light, portable sand and stone drier, there has been developed and put on the market the machine shown in the accompanying illustration.

The machine comprises a drum, 12 ft. long and 24 ins. in diameter, a 6-HP. gasoline engine, an oil tank and oil burner and an air compressor for operating the burner, all mounted on a truck. The drum is jacketed with asbestos at the burner end to prevent radiation, and screens can be placed at the discharge end of the drum for screening out any refuse. The drier is of the continuous type, the heat being supplied by the burner previously referred to.

In operation, the charging end of the drum is slightly elevated, the burners are lighted and the materials are shoveled into the drum. The drum is rotated by the engine and the materials pass through entirely by gravity, being kept in constant agitation by a series of flights inside the drum.

The machine can be used on the job for supplying hot sand, pebbles, or similar material; may be utilized in connection with a small asphalt plant as an auxiliary unit, or



RAPID SAND AND STONE DRIER.

may be used for any other work where dry and hot aggregates are required. Hot materials are produced in from 8 to 10 minutes after the machine is started and the output can be easily regulated both as to quantity and temperature.

The machine is known as the Rapid Sand and Stone Drier and is manufactured by the Rapid Mixer Co., of Grand Rapids, Mich.

Motor-Driven Squeegee

A combination of the motor truck and squeegee which strikingly illustrates the tendency toward "motorizing" the machines used for highway work is shown in the accompanying illustration. The machine is a combination of the Sterling motor truck and the Kindling squeegee, and consists of a special worm-driven chassis, upon which is mounted a water tank with flushing nozzles and a squeegee.

The truck frame consists of 7-in. pressed steel members, inlaid with heavy oak sills. The motor is of the truck type, of 45-HP. (brake), with a normal speed of 1,040 r. p. m. The wheel base is 158 ins. and the gauge 60 ins. in front and 66 ins. in the rear. The front tires are 36x4-in., single, and the rear tires 36x5-in., dual. The truck has three speeds forward and one reverse, and, as indicated, is worm-driven.

The water tank is oval in shape, constructed of heavy gauge steel, and has a capacity of 1,000 gals. It is supported on the chassis in four U-shaped cradles and is attached by four steel bands passing over the tank. The sprinkling nozzles, as shown, are placed in front of the forward wheels so that when in operation all four wheels are on the wet pavement. The squeegee roller is driven from the secondary shaft of the transmission and is situated near the center of the machine, as shown.

The water carried by the tank is sufficient to wash from 3,500 to 5,000 sq. yds. of pavement, depending upon the condition of the street. The cleaning capacity per day of the machine is given as from 80,000 to 115,000 sq. yds. of pavement, depending upon the character of the surface.

The machine is known as the Sterling-Kindling Motor Squeegee, and is manufactured by the Sterling Motor Truck Co., of Milwaukee, Wis.

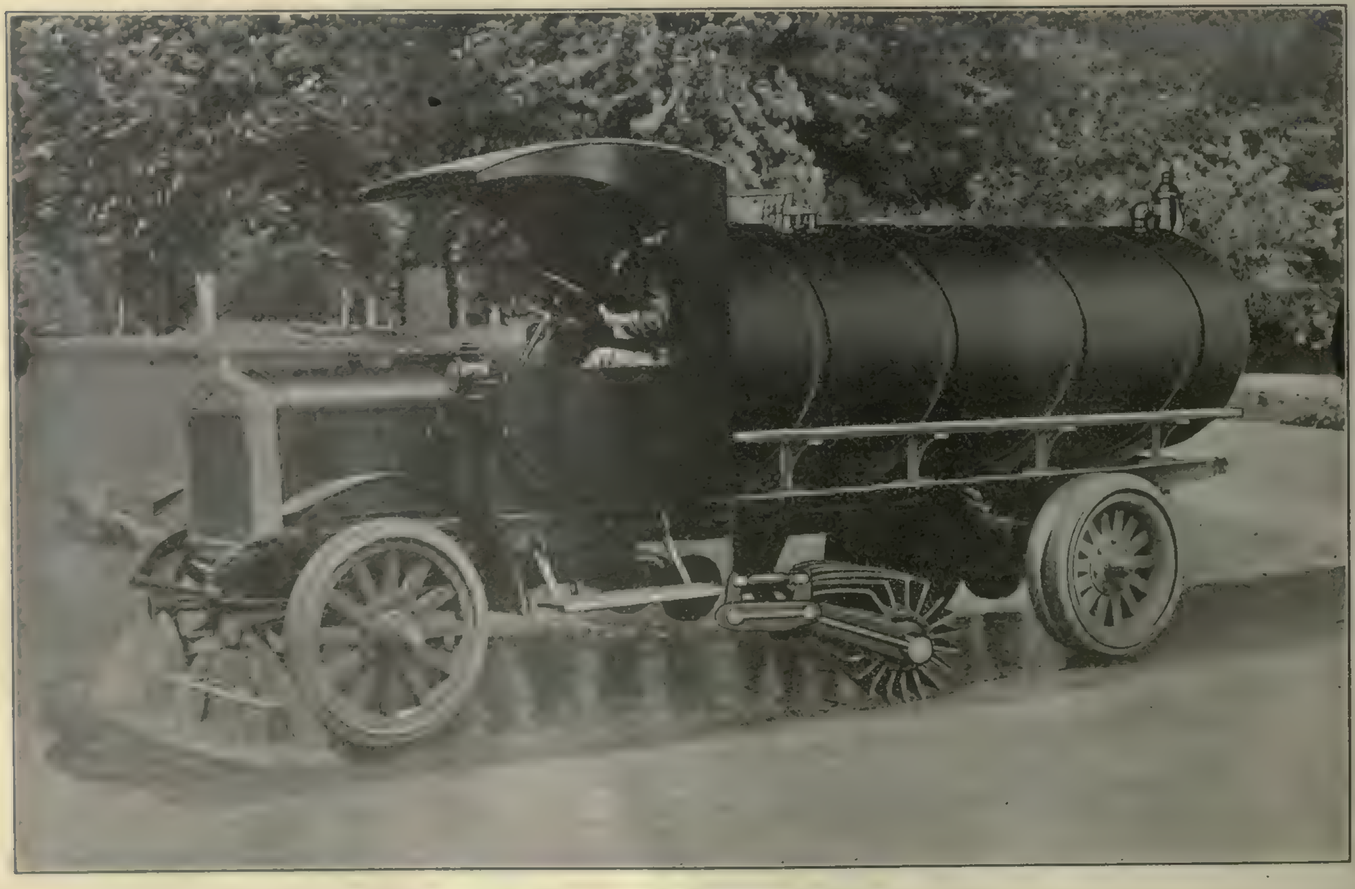
New Kelly-Springfield Trucks

One of two new models of the Kelly-Springfield truck recently put on the market is shown in the accompanying illustration. The two machines are designated as models K-32 and K-36, the former being a 1½-ton truck and the latter a 2½-ton truck. The one shown in the illustration is the K-32. These models differ from the other models of the same line in that they are worm-driven.

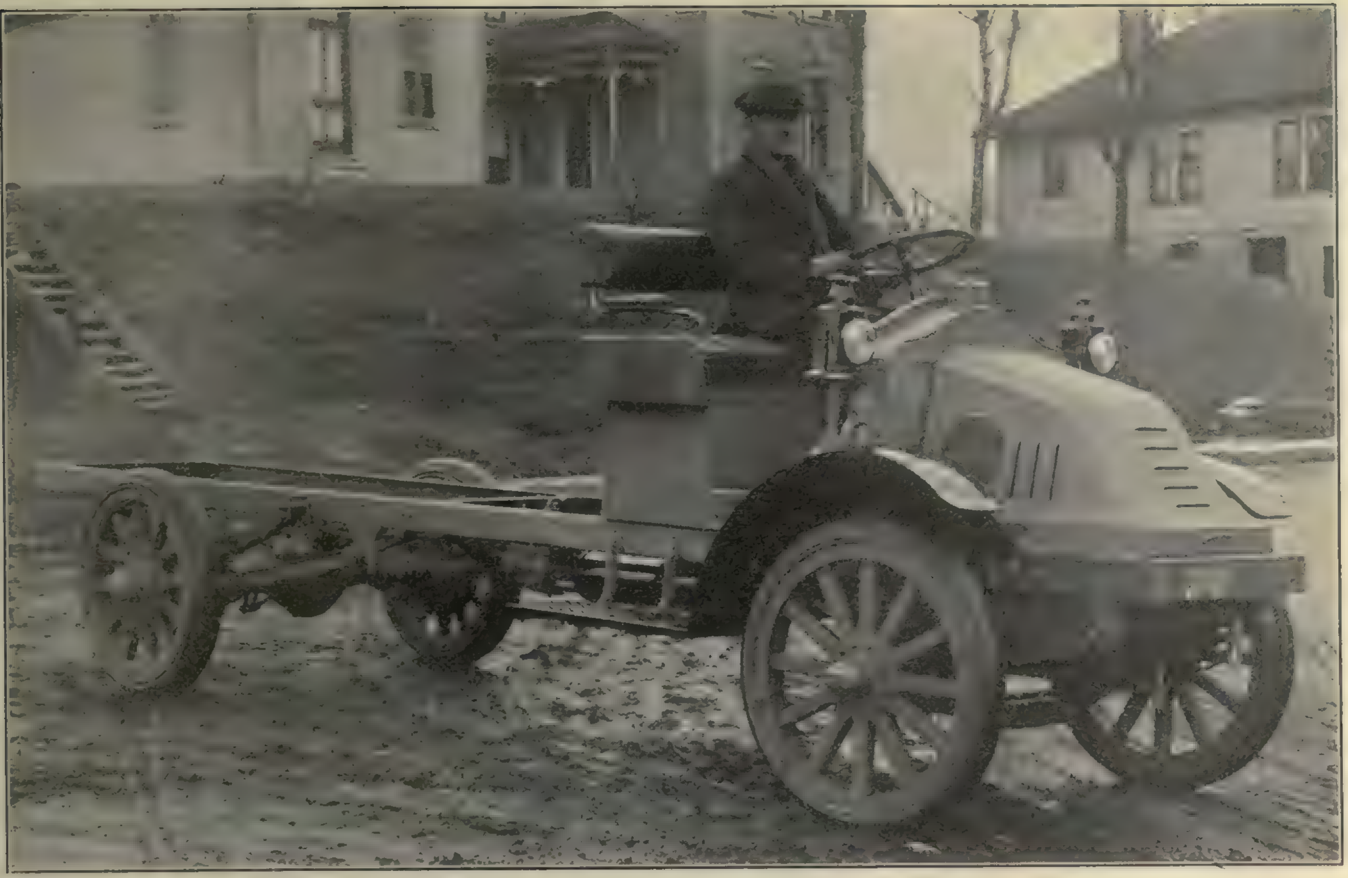
The model shown has a 4-cylinder, 4-cycle motor, the cylinder having a bore of 3¾ ins., and a stroke of 5¼ ins. The motor is equipped with a Model GL2 Rayfield carburetor and an Eisemann ignition system. It is water cooled. The radiator is of the honeycomb type, the water being circulated by a centrifugal pump situated at the forward end of the motor. The transmission is of the sliding gear selective type, with three speeds forward and one reverse, and the axle is driven by a worm of the straight type, mounted above the gear. The frame is of pressed steel channel sections.

The wheel base is 120 ins., and the loading space, 9 ft. Optional wheel bases are 144 ins., 168 ins. and 180 ins., with corresponding loading spaces of 12, 15 and 15 ft. The standard front tread is 56 ins., and the rear 60 ins. The standard tire equipment consists of 36x3½-in. solid front tires and 36x5-in. solid rear tires. The steering column is located on the left-hand side, with the gear shift and emergency brake at the operator's right.

Model K-36—the 2½-ton truck—has practically the same specifications, except that the construction is somewhat heavier.



STERLING-KINDLING MOTOR SQUEEGEE.



KELLY-SPRINGFIELD WORM-DRIVEN 1½-TON TRUCK.

The truck is manufactured by the Kelly-Springfield Motor Truck Co., of Springfield, Ohio.

Steel Forms Used for Road Work in Marion County, West Virginia

An instance of the extensive use of steel forms in road work is reported from Marion County, West Virginia, where Blaw steel forms were used by the Pietro Paving & Construction Co., of Morgantown, W. Va., in the performance of a large contract for brick paving.

Wood forms were used at the beginning of the work, but were later abandoned because of warping. The steel forms used consisted of two 6-in. Blaw universal rails, bolted together for the back of the curb, and a single 6-in. rail formed the front of the gutter. A wooden face rail was used at the front of the gutter and was removed as soon as the concrete was placed to permit prompt finishing. Expansion joints were taken care of by dividing plates, which were removed before the side rails and used as templets for striking off. Flexible rails were used on curves.

It is reported that with the steel forms, over 1,000 ft. of curb and gutter were set in one day at a cost of less than 50 per cent. of the cost with wooden forms. The Blaw forms are made by the Blaw Steel Construction Company, of Pittsburgh, Pa.

Fiftieth Anniversary of Merchant & Evans Co.

To fittingly observe the fiftieth anniversary of its establishment, the Merchant & Evans Co., Philadelphia, Pa., has built a large modern office and warehouse adjoining its works on Washington Avenue, and the removal of its general offices and warehouse to the new location has been completed.

The business was established in 1866 as Merchant & Co., by Clark Merchant, and dealt principally in brass, bronze and copper in all forms as then manufactured, and also in imported tin plate and other metals. Later a dipping plant was erected and the concern manufactured its own tin plate.

The growth of the business made necessary the establishment of branches in various cities and the concern was incorporated under the style of Merchant & Co., Inc., with Clark Merchant as President. Later, on the death of Mr. Merchant, Powell Evans assumed control and the name of the company was again changed to the Merchant & Evans Co.

Under Mr. Evans' management, the company has enlarged its line to include the manufacture of motor trucks and tractors, as well as a line of automobile parts. The company now has plants at Philadelphia, Pa., Wheeling, W. Va., and Chicago, Ill., and offices and warehouses in a number of other cities.

TRADE NOTES

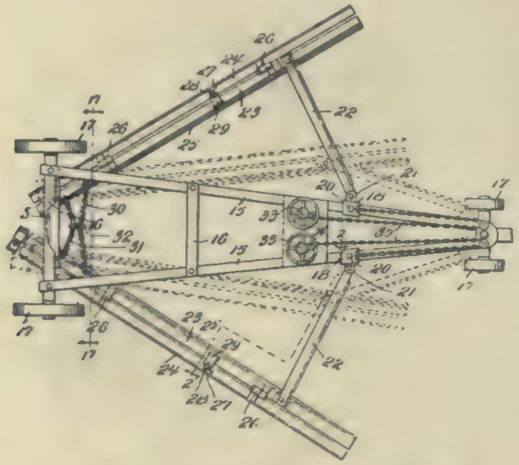
The Asbestos Protected Metal Co., Pittsburgh, Pa., has opened two new offices. One in the Hurt Building, Atlanta, Ga., will be in charge of J. H. Nichols as manager, and the other in the Praetorian Building, Dallas, Tex., will have T. R. Galey as manager.

The United States Cast Iron Pipe & Foundry Co., Burlington, N. J., has announced the removal of its Southern sales and traffic offices from Chattanooga, Tenn., to 1002 American Trust & Savings Bank Building, Birmingham, Ala. The change becomes effective April 1.

"Trinidad Liquid Asphalt for Road Surfacing" is the title of a 16-page booklet recently issued by the Barber Asphalt Paving Co., of Philadelphia, Pa. The booklet covers the use of Trinidad liquid asphalt for road surfacing as distinguished from dust laying. It is attractively printed in two colors and is profusely illustrated.

RECENT PATENTS

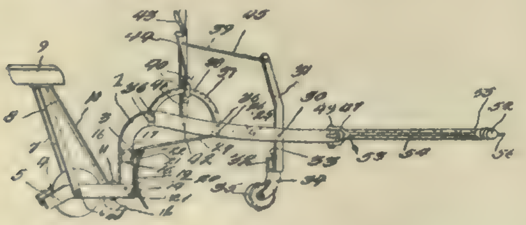
The following list contains the numbers of the principal patents relating to roads and pavements and to machinery used in their construction or maintenance which have recently been issued, together with the names and addresses of the patentees, dates of filing, serial numbers, etc. In some cases the principal drawing has also been reproduced. Printed copies of patents listed may be obtained for 5 cents each by application to the Commissioner of Patents, Patent Office, Washington, D. C.:



1,173,014. ROAD WORKING MACHINE. Nathaniel S. Monroe, Arthur, Ill. Filed Dec. 19, 1913. Serial No. 807,650. (Cl. 37-7.)

1,173,016. ROAD WORKING MACHINE. Nathaniel S. Monroe, Andrew J. Monroe, and George W. Monroe, Arthur, Ill. Filed June 16, 1915. Serial No. 34,379. (Cl. 37-5.)

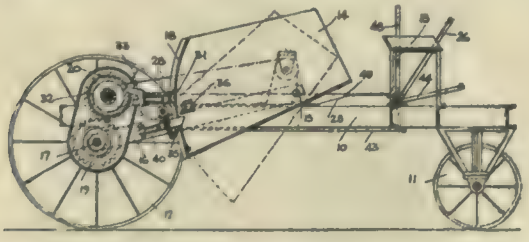
1,173,413. DUMPING WAGON. William J. Colebourn, Louisville, Ky., assignor to Kentucky Wagon Mfg. Co., Louisville, Ky., a corporation of Kentucky. Filed Dec. 20, 1912. Serial No. 737,795. (Cl. 21-20.)



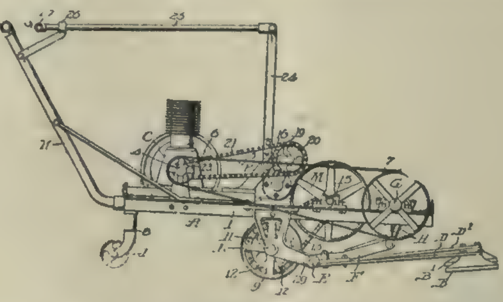
1,173,681. ROAD GRADING AND DITCHING MACHINE. John R. Pile, Owensboro, Ky. Filed Oct. 26, 1915. Serial No. 57,984. (Cl. 37-5.)

1,174,260. PAVEMENT. Thomas F. McGilvray, Duluth, Minn., assignor of one-third to George W. Bestor, Minneapolis, Minn., and one-third to Chas. Gilbert Hawley, Chicago, Ill. Filed Mar. 12, 1913. Serial No. 753,831. (Cl. 94-1.)

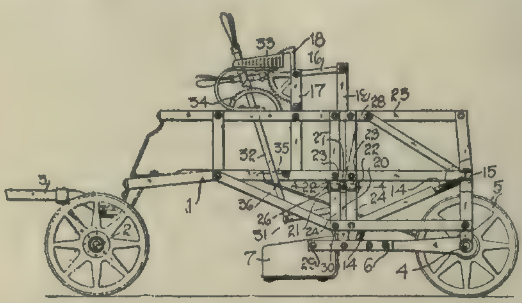
1,174,710. DUMPING WAGON. David Goggins, Branscomb, Cal. Filed Mar. 1, 1915. Serial No. 11,134. (Cl. 21-20.)



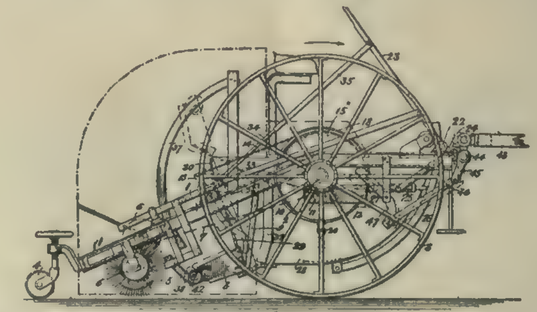
1,174,713. WHEELED SCRAPER. Otto Parker Hallock, Mattituck, N. Y., assignor to Moses V. Liddell, Brooklyn, N. Y. Filed June 12, 1912. Serial No. 703,214. (Cl. 37-33.)



1,174,803. POWER TAMPING MACHINE. Chas. E. Bathrick, Chicago, Ill., assignor to Frederick C. Austin, Chicago, Ill. Filed June 30, 1909. Serial No. 505,206. (Cl. 94-4.)



1,175,263. ROAD MACHINE. Joseph H. C. Hird, Miller, Nebr. Filed April 10, 1915. Serial No. 20,499. (Cl. 37-33.)

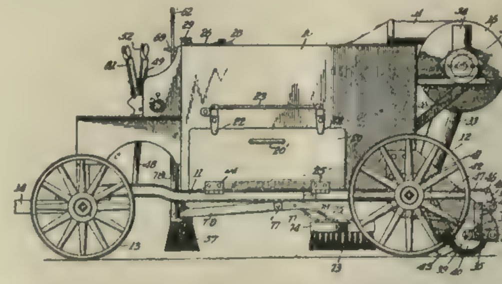


1,175,678. ROAD SWEEPING MACHINE. Walter Barnett and James Florendine, Rugby, England. Filed July 2, 1915. Serial No. 37,640. (Cl. 15-17.)

1,175,822. WHEELED SCRAPER. Henry Clay Rowell, Modesto, Cal. Filed May 25, 1915. Serial No. 30,268. (Cl. 37-33.)

1,176,006. PROCESS OF MANUFACTURING ASPHALT. Reinhold Wallbaum, Sudende, near Berlin, Germany. Filed Nov. 12, 1913. Serial No. 800,675. (Cl. 106-31.)

1,176,154. STREET CLEANING APPARATUS. William Lowy, New York, N. Y. Filed May 26, 1914. Serial No. 840,995. (Cl. 37-6.)



1,176,408. STREET SWEEPING MACHINE. Michael Skrzyszewski, Chicago, Ill. Filed Feb. 15, 1915. Serial No. 8,171. (Cl. 15-17.)

1,176,416. CONCRETE MIXER. Eugene Wiet, San Francisco, Cal., assignor to Parrott & Co., San Francisco, Cal., a corporation of California. Filed Oct. 21, 1913. Serial No. 796,429. (Cl. 94-9.)

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. XLIX
New Series, Vol. XI.

NEW YORK, APRIL 8, 1916

Number 15

Founded January, 1892.
PUBLISHED WEEKLY BY
THE E. L. POWERS COMPANY

E. L. Powers, Pres. and Treas. H. L. Powell, Sec'y.

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Nine West Virginia Counties to Vote on Road Bond Issues

Nine counties of West Virginia will vote on the question of issuing bonds for the construction of roads in one or more districts of each county. The total amount of the proposed bonds is $2,607,800.

The counties in which the elections will be held, the dates of the elections and the amounts of the proposed bond issues are as follows:

Marion County, one district, April 8, $650,000; Richie County, two districts, April 8, $430,000; Greenbrier County, two districts, April 15, $245,800; Logan County, one district, April 22, $200,000; Monongalia County, one district, April 15, $300,000; Wetzel County, one district, April 15, $240,000; Wood County, two districts, April 22, $72,000; Barbour County, one district, April 11, $130,000; Roane County, one district, April 8, $240,000; one district, May 11, $100,000.

New York State Highway Engineers Organize Reserve Corps

As a part of the national program of preparedness, the engineers of the New York State Highway Department have organized The New York State Engineers Reserve, the object of which is to train engineers for officers of the United States Volunteer Service.

The officers of the organization are Alex R. McKim, President; Arnold G. Chapman, First Vice-President; A. E. Steere, Second Vice-President, and Guy V. Sweet, Secretary-Treasurer. An advisory staff is composed of Maj. Gen. John F. O'Ryan, N. G. N. Y.; Col. John F. C. Tillson, U. S. A.; Maj. M. J. McDonough, U. S. Engineer Corps, and Capt. Lorillard Spencer, N. G. N. Y.

The organization is considering more than 500 applications for membership and the total enrollment is expected to reach 1,000. The membership is not confined to civil service employees, but active members must be engaged in the active practice of engineering.

The constitution provides for four classes of membership, namely, active, associate, army-navy-national guard and reserve and honorary. In addition to the officers noted above, the Board of Directors has authority to appoint military officers to act under instructors named by the advisory staff, in the study of drill and field service regulations.

For purposes of organization and training, the state has been divided into eleven districts and each district is subdivided into units located in smaller cities surrounding the district headquarters. These units are composed of nine or more active members.

Delaware County, Indiana, Plans Extensive Highway Work

Plans prepared by County Surveyor Horace J. Weber, of Delaware County, Ind., call for the improvement during 1916 of 48 highways aggregating approximately 91.5 miles. The cost, according to preliminary estimates, will be about $1,000,000.

The roads included in the plan are located in ten different townships and, in addition to the proposed improvements, the construction of 15 new roads is contemplated. It is considered unlikely, however, that these will be built until next year.

Materials specified in Mr. Weber's program are brick, concrete, gravel, tarvia macadam and water bound macadam.

New Jersey Appoints Commission for Delaware River Bridge

A commission appointed by Governor Fielder of New Jersey, to act in the matter of the proposed bridge across the Delaware River from Camden, N. J., to Philadelphia, Pa., has organized with the following officers:

President, Samuel Tilden French, Camden; Secretary, Charles Reade Bacon, Haddonfield; Treasurer, Dr. I. N. Griscom, Camden. Other members of the commission are Thomas J. Barlow, Maple Shade; Col. George Pfeiffer, Jr., Merchantville; Elwood Musinger, Bridgeport; W. F. Morgan, Palmyra; Charles Walters, Woodbury; William S. Cowperthwaite, Medford, and George V. Carr, Pitman.

The commission has $11,500 available for preliminary work and will proceed to have plans and specifications prepared. A similar commission has already been appointed in Philadelphia, Pa.

It is estimated that the proposed bridge will cost between $18,000,000 and $20,000,000. Tentative plans call for a double deck, steel cantilever structure, 1,970 ft. long and 150 ft. above the water.

Street Paving in Nashville, Tennessee, During the Past Year

Under the abutting property law, Nashville, Tenn., laid 106,894.70 sq. yds. of pavement during 1915 in addition to 48,487.97 sq. yds. which was laid at the expense of the street railway interests. These figures are from a report submitted to the Commissioner of Streets by City Engineer W. W. Southgate.

Expenditures by the street railway interests are not included in the report, but the combined cost to the city and property owners of their share of the paving was $251,380.71, divided among various types of pavements as shown in the following table:

TABLE NO. 1.—TYPE, AREA AND COST OF PAVING.

Type.	Railway area sq. yds.	City & Property owners.	Cost to city & property.
Wood block	18,481.06	9,157.50	$23,848.26
Brick	21,468.20	34,960.10	84,497.97
Bitulithic	3,194.31	42,650.00	84,886.22
Granite block	4,513.40	14,722.40	38,726.20
Asphalt penetration	831.00	5,404.70	19,422.06
Total	48,487.97	106,894.70	$251,380.71

In addition to this amount, the city and property owners spent $25,778.21 on the preparation of streets on which no wearing surface was laid last year.

Nashville now has a trifle more than 35 miles of permanent paving, the exact area and type of which is shown below:

TABLE NO. 2.—TYPE AND AREA OF PERMANENT PAVING.

Type.	Sq. Yds.	Miles.
Granite block	137,738	7.826
Vitrified brick	121,757	6.918
Wood block	92,259	5.242
Bitulithic	228,466	12.981
Asphalt penetration	18,762	1.066
Tarvia penetration	15,312	0.870
Bituminous concrete	3,994	0.230
Total	618,288	35.133

San Diego County, California, Plans Road and Bridge Construction

Road and bridge construction involving the expenditure of more than $2,000,000 is contemplated in plans and estimates submitted to the Board of Supervisors of San Diego County, Cal., by County Surveyor George Butler.

The estimates include items aggregating $1,089,800 for building roads and $1,100,000 for bridges. The Board of Supervisors has called an election to be held May 16, when the matter will be voted on.

According to the plans prepared by Mr. Butler, three propositions will be submitted to the voters. One will cover the construction of concrete pavements throughout a number of towns, to connect with the ends of the state highway and also concrete highways in various parts of the county, a total of about 122 miles, at a cost of $1,089,800. The second is for the repair and reconstruction of bridges at a cost of $500,000, and the third is for new bridges at a cost of $600,000.

Greenville, South Carolina, Spent More Than $200,000 for Paving

In his report to the Paving and Street Committee, City Engineer W. F. B. Haynesworth of Greenville, S. C., notes expenditures of $214,205.75 for paving and street work during 1915.

Of this amount $111,958.76 was spent for asphalt pavements, $50,064.26 for brick and concrete, $39,885.35 for sidewalks and curbing and $1,029.27 for paving repairs. The remainder went for salaries and other necessary expenses.

Increased Cost of Snow Removal in New York City

Statistics furnished by the Street Cleaning Department, New York, N. Y., indicate that the cost of snow removal last winter was almost double that of the winter of 1914-15, the cost per cu. yd. being 23 cts., as against 12.1 cts. a year ago. In spite of this increase, however, the 1915-16 cost is considerably lower than that of other years, as the accompanying table shows.

According to Street Cleaning Commissioner Fetherston, the increase over 1914-15 was largely due to the scarcity of labor and the consequent increase in labor costs. Another reason is found in the fact that, in 1914-15, the snow did not freeze hard, as was the case last winter, when it was frequently necessary to break up solid masses of snow and ice before removal was possible.

The plan followed by the department was to first clear the main north and south traffic ways. The most important cross streets and the streets in the wholesale districts followed and attention was then given to the tenement districts where there was danger of the accumulation of refuse. Residential cross streets, where the traffic is light, were the last to receive attention.

The department operated 90 snow plows attached to motor trucks and, according to Commissioner Fetherston, these were an important factor in keeping the cost of snow removal as low as it was.

Winter	Cu. yds. Removed.	Total Cost.	Cost per cu.yd.
1911-12	1,590,235	$870,389	$0.547
1912-13	496,047	245,623	0.495
1913-14	5,180,825	2,473,343	0.477
1914-15	4,318,481	523,892	0.121
1915-16	*10,000,000	*2,300,000	*0.230

*Partially estimated.

New Law for Registering Motorcycles in Force in New York State

It is expected that New York State will receive approximately $100,000 from the registration of motorcycles, the law requiring such registration having become effective on April 1. The license fee is $2.50 regardless of horsepower.

For purposes of motor vehicle registration, New York State has been divided into three zones, as described in "Good Roads" for October 20, 1915. Motorcycle registration will be conducted under a similar system and the license plates will be of the same color as those for automobiles, although much smaller.

Of the money received for registration, one-half is retained by the state and the remainder goes to the counties in which the licensees live.

May 25 Designated as Good Roads Day Throughout Pennsylvania

Governor Brumbaugh of Pennsylvania has issued a proclamation fixing Thursday, May 25 as Good Roads Day throughout the state.

Last year, the day was observed on May 26 and, although rain interfered with the work to some extent, the official figures of the Pennsylvania Highway Department stated that 76,996 men and 13,500 teams had worked on approximately 6,000 miles of roads.

Paving in New York City

The Board of Estimate and Apportionment, New York, N. Y., has granted $900,000 for paving in the Borough of Manhattan during the coming summer.

According to the plans of the Borough President, Marcus M. Marks, portions of 75 thoroughfares will be paved. The materials to be used will be asphalt, granite and wood block.

Good Roads Education

By ERNEST F. AYRES

Road building is an art, and few artists have gained success without first studying the technique of their profession. Medicine is an art, but the physician must take a course of study before he is allowed to practice. The law is an art, but the day has passed when any man of good moral character, and no other qualification, can appear before the bar. Yet no provision has been made to instruct the man who handles a large share of the taxes and who controls the primary transportation facilities of the entire country. And as a rule, he would be highly indignant if anyone suggested that he needed instruction. "Any fool can built roads." They do.

The technical schools are turning out men well qualified to handle the higher priced pavements, the surfacings that will be used on state and national thoroughfares, but these men never get an opportunity to use their talents on the country highways. Everyone knows that a competent engineer is needed to build hard surfaced pavements, but few realize that it takes a better man to handle the funds available in a small road district so as to produce permanent results.

Over ninety per cent. of the roads in the United States are plain earth; passable in summer, but dubious in winter and spring. This ninety per cent. is handled by local talent; sometimes a farmer who is interested in better highways, but more often men who have the desire for political preferment in its most virulent form. These men cannot go to the technical school, but the agricultural college can reach them.

Right here is where the average agricultural college falls down. Most of them offer short courses in highways, nearly all of which are based on a misconception of the needs of the state. This course is given to engineering students only and is devoted almost entirely to the design and construction of city streets. A few lessons are devoted to the study of earth roads, but neither teacher nor pupil takes much interest in this branch of the subject.

There is no doubt that the engineering student needs knowledge of street work to fit him for his profession, but the great opportunities of the future lie in the improvement of the rural highways. The county engineers of tomorrow are being educated at the agricultural colleges, and they should be prepared to handle the problems which will confront them instead of being obliged to depend entirely upon government bulletins.

It is even more important that the agricultural students should be given the opportunity to learn elementary highway construction and maintenance. Here are the future road supervisors, the men who will spend the money. No matter how competent the county engineer may be, the funds will continue to be wasted, as in the past, unless the supervisors are awakened to their opportunities. The present incumbents can be reached by lectures and correspondence courses; the future officials should be trained for the position.

If the college should do no more than correct the usual impression that "good roads" means macadam or some other form of hard surfacing, the saving to the state would more than pay the cost of maintaining the department. The ordinary earth road can be made just as good for light traffic as the bituminous macadam is for the automobile. It is a waste of money to hard surface many of the rural roads where the amount of traffic does not justify the expense, but the earth roads should receive careful attention, rather than the "lick and a promise" they get now. These roads do not need larger appropriations; just more brains.

To serve the people efficiently, the highway department must carry on both college and extension work. The following summary simply covers the points absolutely essential to the success of the good roads movement; others should be added from time to time as the need is shown.

Extension Work

(a) Research work. This should be carried on in both field and laboratory to find the methods of construction and maintenance best adapted to the soil and climatic conditions of each section of the state.

(b) Organize the state, county and district highway officials into an association to study the problems of road building, repair, administration, etc.

(c) Give lectures before high schools, granges, parent-teacher circles, farmers' institutes, good roads associations, etc.

(d) Build demonstration roads at each experiment station maintained by the agricultural college.

(e) Prepare bulletins at frequent intervals giving the results of the research work.

(f) Build road models for use on demonstration trains, at state and county fairs, etc.

(g) Furnish plans and specifications to the several counties and districts, and act as consulting engineer on construction.

(h) Prepare correspondence and reading courses on elementary highway work.

College Work

(a) Give a series of lectures at the short course and during "farmers' week." Two different courses should be given; one to all interested in better highways; the other a more technical course for supervisors and other highway officials.

(b) Give a series of lectures to the teachers at the summer school.

(c) Give a course in elementary highway work to all agricultural students. This course should cover road location, drainage, the design of simple culverts and underdrains, road construction and maintenance.

(d) Give a complete course in highway construction to the engineering students. This course should cover all branches of the subject, from the simplest form of earth road to the highest type of hard surface pavement. The student should be taught to design both roads and bridges, analyze and test his bitumens and cements, write contracts and specifications, figure costs, and organize an engineering and a contract force. He should have a working knowledge of geology and be able to test his road metal.

(e) Give a series of lectures on transportation economics and cost data before the commercial students.

The organization of boys' clubs throughout the state is one of the surest ways of getting the roads improved, but this can be taken up later.

The response from the state will probably be slow, and this is fortunate. The highway engineer needs time for research work before he can undertake the responsibility of advising the county authorities. No two localities present the same problems, and the longer the experience the engineer has had, the more will be realized the necessity of careful study before he dares offer his advice.

All extension work and most of the college lectures can be handled by one man, but he cannot handle the college class work at the same time. During the first year it may be possible to handle both, but after this he will need assistance on the teaching end. He must handle the extension work alone.

The City of Topeka, Kansas, has Awarded Contracts for paving 78 blocks with asphalt and brick at an approximate cost of $250,000.

The Board of Supervisors of Sunflower County, Mississippi, has been asked to submit to the voters a plan to issue bonds to the amount of $750,000 for the construction of 180 miles of concrete roads.

COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

MEETINGS

Good Roads Meeting in Maine

A state-wide good roads meeting was held at Bangor, Me., March 16, with an unexpectedly large attendance. The gathering was planned by the Good Roads Committee of the Chamber of Commerce of Portland, Me., and the Bangor Chamber of Commerce.

The meeting was opened by W. B. Moore, Executive Secretary of the Portland organization, who introduced the chairman, Prof. George T. Files of Bowdoin College.

Aside from Prof. Files, whose address was on the topic "Financing the Good Roads Movement for the Future," the principal speaker was Paul D. Sargent, Maine State Highway Engineer. Mr. Sargent's subject was "Federal Aid in Road Improvement."

The Engineers' Society for Northeastern Pennsylvania, elected the following officers at a meeting held at Scranton, Pa., March 16: President, A. H. Storrs; First Vice President, F. J. Duffy; Second Vice President, J. M. Humphrey; Secretary-Treasurer, T. F. McKenna.

The ninth annual meeting of the Highway Engineers' Association of Missouri was held at the Coates House, Kansas City, Mo., March 21, 22 and 23. Among the speakers was Frank W. Buffum, Missouri State Highway Commissioner, whose topic was "How to get Better Results in Road Building in Missouri."

PERSONAL NOTES

B. C. Brennen has been re-elected City Engineer of Kenosha, Wis. This is his fourth term.

W. L. Benham, of the Benham Engineering Co., Oklahoma City, Okla., has been elected City Engineer of Blackwell, Okla.

Lucius Powers, President of the Fresno, Cal., Good Roads Club, has been appointed a member of the Fresno County Highway Commission.

George F. Cotterill, formerly Mayor of Seattle, Wash., has been appointed Chief Engineer of the Washington State Highway Department.

W. M. Rodgers has resigned as Assistant City Engineer of Racine, Wis., to take effect on May 1. Mr. Rodgers has been in the city service for 26 years.

James Allen has been appointed State Highway Commissioner of Washington, to fill the vacancy caused by the resignation of William R. Roy, noted in "Good Roads" for March 18.

E. O. Brashear, County Engineer of Yakima County, Wash., has been appointed a member of the commission to consider the roads which are to be constructed in connection with the Ranier National Park Development.

John A. Bensel, M. Am. Soc. C. E., formerly New York State Engineer, has been retained by the City of Schenectady, N. Y., in the matter of the proposed Great Western Gateway Bridge, the cost of which is estimated at about $700,000.

NEWS OF THE TRADE

F. William Stocker, Inc., Hoboken, N. J., has issued a folder covering the points of the "Ankerbar" concrete curb protector. The folder is illustrated with half tone reproductions of sections of the curb bar.

"Roads—Their Influence Upon Economic and Social Conditions," is the title of a treatise by S. M. Williams, Sales Manager of the Garford Motor Truck Co., Lima, O., which has been published in booklet form for general distribution by the company.

The Knox Motors Associates, Springfield, Mass., have issued a large folder, printed in two colors and entitled "Hauling Costs Reduced." It contains descriptive matter regarding the Knox tractor and is illustrated with half tone reproductions of the tractor in use.

The Philip Carey Co., Lockland, Cincinnati, O., has issued a 44-page book, printed in colors and profusely illustrated. The subject matter covers the Carey specialties including Elastite expansion joint. The leaves of the book are removable for filing and are provided with filing indices.

The road building equipment manufactured by the J. I. Case Threshing Machine Co., Racine, Wis., is described in a 32-page catalog recently issued. The line covered by the publication includes road rollers, dump wagons, graders, scrapers, drags, rooters, plows, rock crushers, screens and bins, steam and gas and oil tractors.

The Strauss Bascule Bridge Co., Chicago, Ill., has recently issued a somewhat novel addition to advertising literature. It consists of a 16-page booklet, handsomely printed, with jacketed cover, containing a list of the bridges constructed by the company and general information concerning them. The booklet is accompanied by a portfolio containing a number of views of Strauss bridges in the United States and Canada.

The Ransome Concrete Machinery Co., Dunellen, N. J., has reorganized with E. L. Ransome, founder of the business, as Chairman of the Board of Directors and Consulting Engineer. Other officers are Frank L. Brown, President and Manager; A. J. Norton, Secretary, and J. J. Givens, Treasurer. The company will enlarge and modernize its plant. Executive offices have been opened at 115 Broadway, New York, N. Y.

The Jeffery Manufacturing Co., Columbus, O., has added a new department, known as the Contractors' Plant Department, which will develop a line of rock crushing machinery and directly associated equipment. A specialty will be a small portable rock crusher of comparatively large capacity. The new department is in charge of Leroy A. Kling, formerly sales manager of the Road Machinery Department of the Wheeling Mold & Foundry Co., Wheeling, W. Va. It has been practically decided to handle the new line through manufacturers' agencies in various parts of the country.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF GOOD ROADS, published weekly at New York, N. Y., for April 1, 1916.

State of New York, County of New York, ss.:

Before me, a Commissioner of Deeds, in and for the State and county aforesaid, personally appeared E. L. Powers, who, having been duly sworn according to law, deposes and says that he is the Editor and Manager of Good Roads, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, and circulation of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:

Publisher—The E. L. Powers Co., Inc., 150 Nassau St., New York, N. Y.
Editor—E. L. Powers, 150 Nassau St., New York, N. Y.
Managing Editor—No person holding title of Managing Editor.
Associate Editor—T. A. Hulbert, 150 Nassau St., New York, N. Y.
Business Managers—H. L. Powell, 150 Nassau St., New York, N. Y.; E. A. Lyman, 150 Nassau St., New York, N. Y.

2. That the owners are:

The E. L. Powers Company, Inc., 150 Nassau St., New York, N. Y.
E. L. Powers, President and Treasurer, 150 Nassau St., New York, N. Y.
H. L. Powell, Secretary, 150 Nassau St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: No bondholders, mortgagees or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

E. L. POWERS, Editor and Manager.

Sworn to and subscribed before me this 30th day of March, 1916.

(Seal) O. D. CONKLIN,
Commissioner of Deeds. Certificate filed in New York County Clerk's Office, No. 74; New York Register's No. 18,026. Commission expires March 21, 1918.

New York State Senate Passes Bill for Maintenance of Highways

The New York State Senate has passed a bill carrying an appropriation of $3,722,000 for the maintenance of highways throughout the state except within the limits of New York City.

The bill has already been passed by the Assembly and now goes to Governor Whitman for approval.

Paving in Baltimore, Maryland, to be Continued With Limited Funds

The Paving Commission of Baltimore, Md., of which R. Keith Compton is Chairman and Consulting Engineer, has awarded contracts for paving a number of streets, and Mr. Compton has announced that the work will be pushed as in former years.

Owing to the limited amount of money remaining in the paving fund, however, the number of streets which have been placed under contract is small. Under the terms of a bill now before the Maryland General Assembly, however, the city will be permitted to capitalize its paving tax and it is hoped, in this manner, to secure sufficient funds to extend present operations.

It was necessary to make some change in the paving program as announced in several previous issues of "Good Roads," owing to the fact that the Maryland Court of Appeals freed the United Railways of Baltimore from the paving tax which would have amounted to about $1,000,000.

P. C. McArdle Will Superintend Paving in Vermilion County, Illinois

The paving under the $1,500,000 bond issue in Vermilion County, Ill., contracts for which were awarded recently as noted in "Good Roads" for March 25, will be done under the supervision of P. C. McArdle, Assistant Chief State Highway Engineer, who has been loaned to the county by the Illinois State Highway Department. Mr. McArdle prepared plans for the paving and has been identified with the movement for quite a length of time.

As noted in the issue of "Good Roads" referred to above, the paving comprises 141 miles of concrete and 28 miles of brick. It is expected that the work will be completed in about two years.

The Road Improvement Committee of Vermilion County which has been active in the campaign for the bond issue and which has been continued since the issue carried, is composed of the following:

Chairman, O. M. Jones, Danville; W. I. Baird, Jamaica; F. P. Johnson, Hoopestown; M. S. Plant, Danville; J. F. VanAllen, Collison, and A. J. Woodbury, Danville. John S. Olmsted, Chairman of the County Board, and W. S. Dillon, County Superintendent of Highways, are ex-officio members of the committee.

The Use of the "Snow Alarm" in Philadelphia[*]

By WM. H. CONNELL[†]

The snow alarm, or preparedness in the work of snow removal, as it is generally termed in the city of Philadelphia, was an innovation introduced by the Philadelphia Bureau of Highways and Street Cleaning, and has been operating successfully since 1912. The conception and operation of the "snow alarm" in Philadelphia is one of the unique improvements in the Bureau of Highways, which has resulted in greatly benefiting the community. Formerly it was the custom not only in Philadelphia, but in other cities, to wait until the storm was over before beginning the work of removal. In other words, the city did not begin to dig itself out until after the storm had ceased. As a consequence, the traffic was often very seriously congested. The main idea in the snow removal organization of Philadelphia is "preparedness." At any hour of the night, as soon as the snow begins to fall, the Electrical Bureau in City Hall notifies the Chief of the Bureau of Highways and the engineers in charge by telephones in their respective homes. One engineer living in the central part of the city, who acts as Principal Assistant to the Chief in snow removal work, then notifies by telephone the inspectors assigned to the snow plows. These inspectors report at the stables and garages where the respective plows to which they are assigned are kept. Each inspector has the names and addresses of the plow operators and it is his duty to see that the contractor or his representative assigned to the stable or garage makes immediate arrangements to get these men to report to the stable. Arrangements are also made with the Police Department to aid the inspectors in reaching the men, and upon request patrolmen are assigned to this duty. When the plows are ready to start work the inspectors notify the main office and the plows are kept in readiness until ordered to work. This scheme puts the department in control of the plows at the beginning of the storm.

The engineer in charge is in constant communication with the U. S. Weather Bureau and with the Chief of the Bureau of Highways and as soon as the depth of the snow warrants it, the plows are ordered to the work. This engineer keeps an hourly record of the thermometer and barometer readings, the depth of snow and direction of wind, so that we have an exact history of every storm.

As soon as the indications point to a continuance of the storm the entire snow fighting equipment is ordered out, upwards of one thousand telephone messages being sent to various parts of the city, calling out squad leaders, inspectors, drivers, teams, laborers and officers in the various police districts, who aid in getting out the men. This army of laborers and teams keeps constantly at work day and night shoveling and dumping the snow into sewer manholes and into the Delaware and Schuylkill Rivers.

Every man in the snow removal organization has a particular function assigned to him. For instance, each dump inspector knows his post is at a certain dump, and he knows just what to do when he gets there; the driver of every team knows where he is to report, at what point he is to start to load, and at what sewer manhole or wharf he is to dump his loads; and there is no confusion.

Fighting the snow at night during some of the storms we have had in the past three years is no easy task for the Highway Bureau engineers assigned as squad leaders, the inspectors and the laborers, and it requires the constant presence of the Chief of the Bureau and his principal assistants to encourage the men and stir up the necessary enthusiasm to keep the work going.

In the central business section of the city snow is removed from all the thoroughfares. This work is performed under special contracts supplemented by the regular street cleaning force and is under the supervision of a special snow removal organization made up of men assigned to this work from the regular engineering staff.

Certain main thoroughfares and all the street crossings throughout the entire city are also cleaned by the regular street cleaning forces and a large municipal force assigned to the seven highway district engineers who supervise this work. A large force is always employed opening up the country roads, where the drifts often completely block traffic. All told, the force employed on snow removal consists of an army of 4,000 men, 1,200 teams and the advance guard of 38 horse-drawn and 20 motor plows.

Of course during the daytime the mobilization of the snow fighting forces is an easy matter as compared with turning out this force at night, but as the main idea in the Philadelphia snow alarm is simply the practical application of the principle of preparedness in the work of snow removal, the organization has been instructed in the methods that under the circumstances would seem to be best adapted to prevent interruption to traffic during and after a snowfall. It is a known fact that it is practically impossible to get a great number of laborers to work at night during a very severe storm, and to offset this great stress has been laid on the use of the snowplows to keep the streets open to traffic. Of course, whenever the storm occurs in the daytime or at night when the weather conditions are not too severe, considerable of the work is performed by flushing, sweeping and shoveling the snow into sewer manholes and inlets. This method, however, could not be depended upon in a storm such as the blizzard of February, 1914, as it would be practically impossible to get a sufficient labor force to work to keep the streets open to traffic under such severe conditions as existed the first night of the blizzard, and it is for this reason that we use every effort to keep the plows constantly at work plowing the snow to the side of the street during the progress of the storm. This has enabled us to keep the streets open to traffic when we have had difficulty with the labor situation. We have never had very great difficulty, however, in getting enough laborers and teams in the daytime or at night to load the snow piled at the side of the street into the wagons and haul it to the dumps, but we do not depend entirely upon getting sufficient laborers to dispose of the snow by shoveling it into sewer manholes. This feature of the work is simply supplemental to the main feature, which is the use of the plows to keep the streets open to traffic, and after four years' experience with this method we have concluded to increase the number of snowplows and place the main dependence upon them, as it takes very little time to get them on the work and it is possible to keep them at work at all times, even during the most trying conditions. Of course, when the snow is plowed to the side of the street, it simplifies loading it in wagons for disposal.

Early in the fall of each year, the several division engineers and district assistant engineers are required to prepare a complete assignment schedule for all of the forces under their supervision. This schedule constitutes a program of proposed operations and includes a definite assignment for each individual employee or gang, and indicates in detail the point to which each member of the force is to report and just what duties each is to perform. Prior to the advent of snow, the squad leaders are required to fully acquaint themselves with the traffic conditions existing in their respective snow removal districts and with the location and character of the assigned dumping places, the character of and the storage location of the contractors' equipment, and the names and call addresses of both the contractors and the inspectors assigned to their respective squads. They are also required to see that their inspectors and contractors are thoroughly instructed in their respective duties so that there will be no possibility of misunderstanding concerning any detail of the work. All of the employees assigned to snow removal work understand that they are subject to call at any hour of the day or night, and in case of absence from their scheduled call-addresses are required to make suitable arrangements for immediately receiving any notice or order to report for duty that may be sent them. Each gang foreman is also made personally responsible for the notification and reporting on the work of a selected number of the regular municipal laborers living in his locality.

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[*] Extract from a paper presented at the Snow Removal Conference in New York City on March 8, 1916.

[†] Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.

Four California Cities in Project to Build $20,000,000 Bridge

A movement has been launched to connect the City of San Francisco, Cal., with the mainland by means of a bridge across San Francisco Bay at Mission Basin. The Chambers of Commerce of San Francisco, Oakland, Berkeley and Alameda, Cal., are back of the project.

At a recent meeting of the harbor committees of the four organizations, the plans for such a bridge were explained by Col. Rees, United States Board of Harbor Engineers, who has approved them.

The plans were prepared by Harlan D. Miller, New York, N. Y. The proposed bridge would be about four miles long and of an average height of 30 ft. above the water. Four railway tracks are provided for as well as two driveways, one for automobiles and the other for slower-moving vehicles. It is estimated that the cost of such a bridge as the plans contemplate would be about $20,000,000.

Plans for Highway Expenditures in San Diego County, California

Completed plans for the proposed highway work to be done in San Diego County, Cal., under the bond issue which is to be voted upon May 16, as noted in the preceding issue of "Good Roads," involve the expenditure of $2,101,000.

With this amount it is proposed to take care of the following items: 1—Repair and reconstruction of roads, $500,000; 2—Construction of bridges, $400,000; 3—Construction of road on route of state highway, $75,000; 4—Construction of concrete pavement, $1,126,000.

According to Deputy County Surveyor Grumm, the amount under Item No. 1 is mainly for the repair and reconstruction of roads damaged in the recent floods. Item No. 3 covers the construction of approximately 60 miles of road on the route of the state highway, the state agreeing to take over and maintain this mileage. Item No. 4 includes 38 miles of concrete pavement inside incorporated cities on the main roads and 98.4 miles in the county outside of city limits.

Chicago, Illinois, Engineers Organize for Military Training

A number of prominent engineers and contractors of Chicago, Ill., and vicinity, have formed what is known as a Joint Committee on Military Engineering. As its name indicates, the purpose of the organization is to further the study of military engineering and service regulations among engineers, contractors and their associates.

The committee will seek to attain this object by means of courses of lectures, assigned reading, studies and practical instruction in military engineering, instruction in military engineering in training camps and by such other means as may from time to time be deemed advisable.

It will also assist engineers to qualify as officers of the National Reserve Corps of Civilian Engineers and will urge enlistment in and support for engineer troops of the National Guard and such other organizations as the government may create.

A program has already been prepared for a period extending from April 20 to July 25 which includes lectures by officers of the United States Engineer Corps and exhibition drills, terrain exercises and inspection trips under the direction of officers of the Illinois National Guard.

The directors of the committee are: Wharton Clay, Chairman; Robert W. Hunt, Vice-Chairman; Robert F. Hall, Secretary-Treasurer; Bion J. Arnold, W. W. DeBerard, J. deN. Macomb, Jr., H. S. Baker, Robert I. Randolph and Vernon C. Ward, Jr.

Contracts Awarded for More Than 90 Miles of Ohio Highways

The Ohio State Highway Department has made the first important awards of the season of state highway work. The amount of the contracts exceeds $1,250,000 and the work covers more than 90 miles of roads in many counties.

The bidding was very spirited and in a number of instances the bids were considerably below the estimates.

The names of the successful bidders, together with the amounts of the bids and the general character of the work are given below:

Ashland County, Savannah-Vermillion Rd., constructing bridge, G. E. Scott, Mansfield, $6,657.58.

Ashtabula County, Cleveland-Buffalo Rd., 6.47 miles brick Heysteck-Baker Co., Kalamazoo, Mich., $140,760.73. Jefferson-Andover Rd., 6.3 miles brick, T. W. Hadley, Canton, $86,400.

Belmont County, Barnesville-Hendrysburg Rd., 2.41 miles brick, A. Emery & Son, Zanesville, $57,396.74.

Butler County, Hamilton-Middletown Rd., constructing steel bridge, repairing substructure, grading roadway, etc., Capital Construction Co., Columbus, $3,085.45.

Champaign County, Urbana-Sidney Rd., repairing Mad River Bridge, Brookville Bridge Co., Brookville, $1,074.

Columbiana County, Cleveland-E. Liverpool Rd., 0.98 mile brick, Reinhardt Bros., E. Liverpool, $20,020.95.

Darke County, Celina-Greenville Rd., 3.08 miles reinforced concrete, Mueller Construction Co., Columbus, $43,908.94.

Erie County, Sandusky-Norwalk Rd., 2.09 miles, Earl Walters, Sandusky, brick and water bound macadam, $28,185; brick, concrete and macadam, $24,240; reinforced concrete and brick, $30,474.

Franklin County, Columbus-Sandusky Rd., 0.72 mile brick, R. G. Culbertson Co., Richmond, Ind., $45,848.

Greene County, Dayton-Chillicothe Rd., 2.21 miles water bound macadam, A. G. Barney, Dayton, $12,635.

Guernsey County, Cambridge-Caldwell Rd., 1.25 mile bituminous macadam, Sipple & Wolf, Youngstown, $12,728.85. National Rd., 7.48 miles surface treated macadam, W. H. Young Co., Columbus, $96,160.15.

Harrison County, Dennison-Cadiz Rd., 3.59 miles water bound macadam, R. L. Timmons, Cadiz, $35,764.04.

Holmes County, Columbus-Millersburg Rd., 1.56 mile concrete, Holmes Construction Co., Millersburg, $24,255.83.

Jefferson County, Steubenville-Cambridge Rd., 1.15 mile water bound macadam, S. T. Frazer, Bloomingdale, $14,833.55.

Licking County, Columbus-Millersburg Rd., 0.55 mile water bound macadam, Charles Voglemier, Newark, $5,509.01.

Madison County, Urbana-London Rd., 3.07 miles concrete and 0.21 mile brick, R. G. Culbertson, Richmond, Ind., $58,455.

Mahoning County, Akron-Canfield Rd., 2.46 miles waterbound macadam, T. H. Young Construction Co., W. Austintown, $20,281.66. Youngstown-Salem Rd., 1.5 mile water bound macadam, Smith Construction Co., Youngstown, $12,147.55.

Montgomery County, Dayton-Troy Rd., 1.01 mile brick Brentingler & Anderson, Dayton, $21,212. Cincinnati-Dayton Rd., 1.47 mile brick, R. G. Culbertson, Richmond, Ind., $34,040. Dayton-Troy Rd., 1.29 mile brick, Brentingler & Anderson, Dayton, $28,282.

Morrow County, Marion-Galion Rd., 2.46 miles water bound macadam and concrete, Mustard Bros., Ada, $23,950. Mt. Gilead-Mt. Vernon Rd., J. A. Westrick, Holgate, water bound macadam, $78,000, Grohne Contracting Co., Joliet, Ill., concrete, $97,293.

Ottawa County, Port Clinton-Marblehead Rd., 3.5 miles, Gray Bros., Bowling Green, tar macadam, $23,345. Pearson & Welch, Fremont, asphalt macadam, $24,429.91.

Portage County, Cleveland-Kent Rd., 2.47 miles concrete, Mueller Construction Co., Columbus, $37,791.70.

Sandusky County, Fremont-Port Clinton Rd., 1.2 mile reinforced concrete, Zeigler & Reardon, Fremont, $16,874. Sandusky-Clyde Rd., 1.09 mile brick, Lee Bros. & Petticord, Clyde, $22,706.45. Fremont-Castalia Rd., 1.01 mile water bound macadam, Pearson & Welch, Fremont, $7,994.58.

Scioto County, Ohio River Rd., 2.95 miles, Sherridan & Kirk, Portsmouth, brick on concrete, $62,052.89; brick, rolled foundation, $52,079.42; asphalt macadam, $36,759.95; tar macadam, $36,759.96.

Seneca County, Tiffin-Bellevue Rd., 1.59 mile water bound macadam, B. D. Knepper, Tiffin, $13,999.40. Upper Sandusky-Bellevue Rd., 2.46 miles water bound macadam, W. H. and H. G. Souder, Fostoria, $19,587.

Summit County, Akron-Medina Rd., 1.62 mile brick, Morgan Bros., Ravenna, $32,000.

Tuscarawas County, Newcomerstown-Uhrichsville Rd., 0.82 mile brick, J. T. Norman & Son, Lafayette, $14,867. Canal Dover-Millersburg Rd., 1.64 mile reinforced concrete, Pace Bros., Cleveland, $23,480. Canal Dover-Wooster Rd., 1 mile brick, Holmes Construction Co., Millersburg, $15,505.42.

Wayne County, Massillon-Wooster Rd., 5.83 miles brick, Richard Shaffer Co., Findlay, $76,500.

Williams County, W. Unity and Montpelier Rd., 1.94 mile water bound macadam and reinforced concrete, Zeller & Daum, Swanton, $19,985.88.

Lake County, Painesville-Warren Rd., 1.52 mile asphalt treated macadam, J. C. Devine Co., Alliance, $10,990.

COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-July 1—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

PERSONAL NOTES

Frank Lotz has been appointed City Engineer of Vader, Wash.

S. A. Cobb has been appointed Highway Engineer of Clackamas County, Ore.

R. T. Wells has resigned as City Engineer of Parsons, Kan., to go into private practice at Bartlesville, Okla.

Ernest P. Goodrich has resigned as Consulting Engineer of the Borough of Manhattan, New York, N. Y., to engage in private practice.

H. O. Halbert has resigned as Assistant Road Engineer of Baltimore County, Md., to join George W. Drury, a bridge contractor in New York, N. Y.

Ralph L. Rizer, who has been Assistant City Engineer of Cumberland, Md., has been appointed City Engineer by the newly elected City Commission.

A. R. Cullamore has resigned from the Engineering Department of Toledo University to become Dean of the Engineering Department of Delaware College.

Samuel L. Green has been appointed Assistant Road Engineer of Baltimore County, Md., to succeed H. O. Halbert, whose resignation is noted elsewhere in this column.

H. L. Dougherty has been appointed Superintendent of Highways in Washington County, Pa. He has been attached to the forces of the Pennsylvania State Highway Department for the past four years.

NEWS OF THE TRADE

The Indiana Paving Brick & Block Co., Brazil, Ind., has been added to the list of licensees of the Dunn Wire-Cut Lug Brick Co., Conneaut, O.

The Packard Motor Car Co., Detroit, Mich., has issued Catalog B, covering the Packard chainless motor trucks of from two to four and one-half tons capacity.

Catalog No. 2, recently issued by the J. D. Fate Co., Plymouth, O., describes the Plymouth gasoline industrial locomotive and contains numerous half tone illustrations of the locomotive and its various parts.

The Koehring Machine Co., Milwaukee, Wis., announces the removal of two of its Pacific Coast branches. The Portland, Ore., address is now 254 East Hawthorne Avenue, and the Seattle, Wash., branch is now located at 1208 Western Avenue.

The Heltzel Steel Form & Iron Works, Warren, O., has issued a booklet bound in the form of a set of specifications and detailing the advantages of the Heltzel hanging system of concrete road forms. The publication is illustrated with half tone reproductions of the various forms in use.

E. I. duPont deNemours & Co., Wilmington, Del., have just issued a book on clay blasting, which contains some valuable and interesting information. In addition to full information on the use of explosives, some of the points covered in the book are digging clay, stripping, blasting down shale and draining clay pits. The book is intended for free distribution.

The Albemarle-Salisbury Highway Association was formed recently at Albemarle, N. C. J. A. Groves and A. L. Patterson, both of Albemarle, are respectively President and Secretary.

Columbia University, New York, N. Y., will hereafter confer the degree of Master of Science on graduate engineering students who satisfactorily complete the graduate course in highway engineering. Since 1911 such graduate students have been candidates for the degree of Master of Arts.

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Notice to discontinue subscription should be sent to the New York office.

Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Bond Issues for Road Construction in Tennessee Counties

Several counties of Tennessee are making provision for extensive road work during the present season and a number of bond issues have been planned for the purpose of financing the undertakings.

Obion County will vote in May on an issue of $500,000 to construct 160 miles of roads. Humphreys County contemplates an issue of $200,000. Henry County will have an election in August on a $250,000 issue. Hardin County will vote June 3 on an issue of $100,000. There will be an election in Morgan County May 20 on an issue of a similar amount and the authorities of Chester County will call an election on a $100,000 issue.

Pennsylvania Boroughs Not to Receive Aid From State

The Pennsylvania State Highway Department has been informed by the State Attorney General's Department that it is not permitted to construct or improve as a state aid highway any section of a state highway route within the limits of a borough or a township. This opinion upsets the plan under which the State Highway Department has been working.

As a result, a number of the boroughs and townships wherein the State Highway Department has planned to do work during the coming season will be deprived of the opportunity to gain improved highways.

The Attorney General's Department also ruled that on sections of the state highway already constructed within the limits of a borough, the borough is liable for the cost of maintenance if the pavement is constructed of "permanent material." If the construction is of a type not coming within this classification, the State Highway Department is liable for 50 per cent. of the cost of maintenance. This expense, however, must come out of the state highway funds and not out of the state aid funds.

Appropriation of $3,000,000 for Maryland Roads and Bridges

The Maryland General Assembly passed a bill introduced by Senator Harrison, Chairman of the Committee on Roads and Highways, providing for a bond issue of $3,000,000 for the construction of roads and bridges.

It is intended to use the money for the purpose of completing gaps in the state road system and for building bridges in Cecil County and across Sinepuxent Bay at Ocean City.

Minnesota Plans to Improve a Large Mileage of Roads

According to figures prepared in the office of the Minnesota State Highway Commission, the state will improve more than 3,000 miles of roads during the current year.

It is planned to gravel about 1,000 miles and an aggregate of more than 2,000 miles will be graded and otherwise improved. The cost is estimated at $7,453,451.

A number of the counties of the state have notified the commission of their intention to improve 1,832 miles of roads. Winona County will issue bonds to the amount of $500,000 and a bond issue of $2,000,000 is being urged in Hennepin County.

Important Grade Crossing Elimination in Western New York

The Public Service Commission for the Second District of New York State has ordered the elimination of the Harlem Ave. grade crossing in Sloan, Erie County. This has been described as one of the most dangerous crossings in the state, there being 57 railroad tracks crossing one of the main automobile routes.

The commission's order provides for the construction of a viaduct, approximately a quarter of a mile long, across the railroad tracks. The cost will be about $400,000 of which $100,000 will be paid out of the state grade crossing fund.

According to present plans the viaduct will be of steel with concrete floor and will have a 24-ft. brick roadway and one 6-ft. sidewalk. The approaches will be constructed with a 4 per cent. grade and will be paved with macadam.

In connection with the elimination plans, the Lackawanna Railroad has offered to construct an undergrade crossing at Lovejoy St., west of Harlem Ave.

Additional Street Work to Be Let in Philadelphia, Pennsylvania

In addition to street work recently awarded by the Bureau of Highways, Philadelphia, Pa., as noted in "Good Roads" for April 15, the city will receive bids next Tuesday for work the estimated cost of which is figured at $279,340.

The largest item on the present list is $83,165 for grading and the next is $54,175 for asphalt paving. Other items are asphalt repaving, vitrified and granite block paving, surfacing and resurfacing with water bound macadam, painting and repairing bridges. There is an item of $36,000 for the improvement of Oxford Ave.

Governor Fielder of New Jersey Signs $7,000,000 Road Bill

A bill authorizing a bond issue of $7,000,000 for public road purposes, has been signed by Governor Fielder of New Jersey and will be submitted for the approval of voters at the November election.

The bill originated in the State Senate and there was some question as to its constitutionality on this account, the New Jersey law providing that revenue raising measures shall have their origin in the Assembly. The State Attorney General's Department, however, decided that the bill did not conflict with the law.

Active Preparations for Good Roads Day in Pennsylvania Counties

The work of preparation for the observance of Good Roads Day in Pennsylvania is being actively prosecuted by the counties of the state. County organizations which were formed last year for the arrangement of details, have been reorganized for the purpose of making this year's observance of the day a success.

Governor Brumbaugh who, as stated in the issue of "Good Roads" for April 8, has set May 25 as the date for the state-wide observance of Good Roads Days, has placed himself at the disposal of the Pennsylvania State Highway Department for work on the roads.

Merced County, California, Plans to Build Concrete Highways

Tentative plans for building approximately 100 miles of concrete highways have been made by the Board of Supervisors of Merced County, Cal., and preliminary steps have been taken looking to the issuance of bonds to defray the cost of construction.

Inasmuch as a state highway bond issue is to be voted on in California at the November election, the Merced County authorities have decided to withhold the proposed county bonds until information with regard to the exact course of the state system is made available by the State Highway Department.

Peruvian Government Grants Concession For a Mountain Road

The Government of Peru has granted to Adolfo Hilfiker a concession for the construction of a pack road from the station of Urcos on the Juliaca-Cuzco Railway and a point on the River Querene or the River Madre de Dios. The road will be approximately 125 miles long and 8 ft. wide.

The concession provides that where swamps are encountered they must be drained and the roadway laid with stone. Streams must be bridged or rafts and canoes provided for crossing. Much of the road will run through dense forests which will have to be cleared. Way stations must be constructed every 15 miles and freight in transit may be stored at these buildings free of charge for ten days or less. No toll is to be collected and the concessionaire agrees to keep the road in condition for a period of 30 years, at the end of which time it is to revert to the government. A telephone and a telegraph line are to be installed and communication must be furnished to the government free of charge.

In consideration of the service, the government grants to the concessionaire the absolute ownership of 2,471 acres of mountain land for each kilometer of road constructed, or a total of nearly 500,000 acres. The government also agrees to grant no concession for competing roads within 15 years. The road must be completed within four years.

State of Ohio Calls for Bids on Large Amount of Road Work

Bids are to be received on Friday of next week by Clinton Cowen, State Highway Commissioner of Ohio, for highway work in twenty-four counties of the state. The work includes approximately 81.84 miles of road construction of various materials and the cost, according to estimates, will run considerably over $1,000,000.

Most of the contracts include bridge and culvert construction as well as road work, and all are set for completion at dates ranging between August 1 and December 1. The various items and estimates and the counties in which the work will be done, are as follows:

Champaign, 1.56 mile water bound macadam, $13,059.16; Clark, 4.35 miles surface treated macadam, $48,619.83, alternate estimate on water bound macadam, $43,718.31; Columbiana, 3.01 miles bituminous macadam, $33,968.45; Crawford, 1.69 mile brick, monolithic type, $33,490.96; 1.03 mile brick, monolithic type, $20,728.60, alternate estimate on semi-monolithic type, $21,142.60; 0.5 mile brick, $10,563.12; Delaware, 0.97 mile bituminous macadam, $12,117.15, alternate estimate on reinforced concrete, $14,931.95; 3.72 miles bituminous macadam and reinforced concrete, $38,362.05, alternate estimate on reinforced and plain concrete, $37,360.64; 1.90 mile bituminous macadam, $22,555.05, alternate estimate on reinforced concrete, $31,379.55; Franklin, 0.76 mile brick, semi-monolithic type, $50,455.11; Geauga, 2.97 miles concrete, $35,910.61; 2.50 miles concrete and brick, $29,055.70, alternate estimate on brick, $29,338.84; Greene, 5.67 miles water bound macadam, $34,235.64; Jefferson, 0.90 mile water bound macadam, $14,556; 0.72 mile brick, $22,867.76; Knox, 2.06 miles water bound macadam, $22,978.51, alternate estimate on bituminous macadam, $26,708.83; 4.18 miles water bound macadam, $49,011.59, alternate estimate on bituminous macadam, $57,253.67; Logan, 4.15 miles water bound macadam, $28,350.50; Mahoning, 1.31 mile water bound macadam, $12,235.70; Mercer, 3.08 miles reinforced concrete, $45,422.64; Miami, 5.03 miles bituminous macadam, $52,756, alternate estimate on reinforced concrete, $70,780.10; Monroe, 1.92 mile bituminous macadam, $34,333.68; Muskingum, 1.35 mile brick, $27,480.51; Portage, 2.40 miles brick, $40,539.50, alternate estimate on concrete, $32,236; Ross, 1.02 mile brick, $14,498.94; Stark, 5.78 miles brick, $135,661.78; Tuscarawas, 2.37 miles brick, $49,168.93; Union 0.21 mile reinforced concrete, $3,352.94; Washington, 2.03 miles tar bound or asphalt bound macadam $31,511.81 for tar, $32,464.56 for asphalt; Wood, 10.75 miles bituminous macadam or bituminous concrete, $96,702.65 for bituminous macadam, $106,928.45 for bituminous concrete, asphalt, and $104,656.05 for bituminous concrete, tar. Maintenance and Repair Department, Ashland County, 1.55 mile resurfacing with water bound macadam, $18,786.13.

The Ohio State Highway Department recently awarded contracts for more than 90 miles of road construction as noted in the preceding issue of "Good Roads."

Plan to Free Toll Bridges Across the Delaware River

The states of Pennsylvania and New Jersey are acting in concert in an effort to free 16 toll bridges across the Delaware River between the two states.

Appropriations of $100,000 each have been made by the legislatures of the two states and the work of freeing the bridges will commence immediately the money is available. A commission known as the New Jersey and Pennsylvania Free Bridge Commission has charge of the details.

It is planned to have the legislature of each state appropriate $100,000 annually for five years, including the present appropriations, making a total of $1,000,000 which, it is believed, will be sufficient to accomplish the work contemplated.

Eight Bridges to Cost Wyandotte County, Kansas, $1,727,000

Wyandotte County, Kan., has planned the construction of eight bridges over the Kaw River to replace those destroyed by floods, the cost of which will be $1,727,000 and will be met by bond issues.

Some of the bridges have been completed and others are under construction. The cost of the separate items of the bridge building program is shown below.

Bridge.	Cost.
Southern	$125,000
Fifth Street	30,000
James Street	160,000
West Kansas Avenue	227,500
Turner	40,000
East Kansas Avenue (23d Street)	500,000
Central Avenue	600,000
Argentine (12th Street)	45,000
Total	$1,727,000

Chicago, Illinois, Has Provided for Large Yardage of Brick Pavement

According to statistics compiled by the Paving Brick Publicity Bureau, Chicago, Ill., that city had provided for a total of 1,950,680 sq. yds. of brick paving up to April 15.

Of this yardage 105,425 sq. yds. are already under contract. The remainder is in various stages of preliminary progress. The exact status of the entire yardage is shown in the following table:

	Sq. Yds.	Sq. Yds.
Estimates ordered on new work:		
Streets	413,706	
Alleys	549,000	
		962,706
Passed public hearings:		
Streets	141,682	
Alleys	69,000	
		210,682
Ordinance passed by Council:		
Streets	203,877	
Alleys	99,000	
		302,877
Pending in Court:		
Streets	239,560	
Alleys	91,000	
		330,560
Confirmed by Court but not contracted for:		
Streets	8,665	
Alleys	29,765	
		38,430
Work under contract		105,425
Total		1,950,680

Proposed Connection With the Southfield Boulevard, Staten Island, New York

At a meeting of the Board of Estimate and Apportionment of New York City, held last week, a resolution was adopted which makes possible the construction of a part of the necessary connecting highway between Broad street, Stapleton, and the northerly end of Southfield Boulevard in the Borough of Richmond, New York City.

Some years ago, before Staten Island was a part of the City of New York, a number of property owners presented to the County of Richmond the right of way for a boulevard about 7 miles long running northerly and southerly from a point a few miles northeast of Tottenville to a point a few miles southerly of Stapleton. The highway—Southfield Boulevard—was built and at present is a well macadamized street, 100 ft. in width, and if supplied with the proper connecting highway at either end would form part of a through route between New York and New Jersey shore points.

The resolution adopted by the Board of Estimate authorizes the city to vest title in certain damage parcels on the westerly side of Riker St., which extends from Broad St., Stapleton, toward the northerly end of Southfield Boulevard. By this action the street will be made 75 ft. wide from Broad St. to the Garibaldi Memorial at Rosebank.

When this is improved there will however remain a stretch of something over a mile and a half between the Garibaldi Memorial and the northerly end of the boulevard. Plans for the construction of a boulevard over this distance were made some time ago, but owing to a technical defect in the proceedings which was discovered after the appointment of commissioners, the work was never done. Now that the Riker St., or Rosebank Ave., matter has been settled, the improvement of the remaining link is being urged by property owners along Southfield Boulevard, and by others interested in the development of Staten Island.

NEWS NOTES

The Bond Commission of Norfolk, Va., has awarded contracts for concrete roads involving the expenditure of $140,000.

The Board of Supervisors of Herkimer County, N. Y., has approved plans for 35.06 miles of roads to cost $275,000.

The Department of Public Improvements, Allentown, Pa., plans to lay approximately 55,000 sq. yds. of pavements this season.

The Voters of Kane County, Ill., have voted against a proposition to issue bonds to the amount of $1,500,000 for the construction of roads.

The Fiscal Court of Scott County, Ky., has decided upon the reconstruction of 56 miles of inter-county seat highways with the proceeds of a $100,000 bond issue.

County Engineer George C. Diehl of Erie County, N. Y., has submitted to the Board of Supervisors a list of 15 roads, aggregating 101.29 miles, to be improved in 1917.

The Lafayette County Good Roads Association has been organized at Oxford, Miss., with the following officers: President, C. E. Sisk; secretary, C. C. Hughes; treasurer, S. H. Logan.

The New York State Senate has passed a bill permitting the Board of Supervisors of Onondaga County to purchase the right of way for a highway from Syracuse to the State Fair Grounds. The highway will cost about $400,000 of which 65 per cent. will be paid by the State.

The duPont-Davis Road Photograph Prize Contest has recently been announced by the National Highways Association. According to the announcement, cash prizes to the amount of $2,600 will be given for photographs of roads. The photographs will be judged, it is stated, "first upon their merit in showing road conditions (good or bad); second, pictorial interest; third, photographic excellence." The prizes consist of one first prize of $500, five second prizes of $100 each, twenty third prizes of $25 each, forty fourth prizes of $15 each, and one-hundred fifth prizes of $5 each. The competition is open to anyone and entries should be addressed to "Good Roads Everywhere" Photographic Contest, National Highways Association, Washington, D. C. The prizes were subscribed by Gen. Coleman duPont, Chairman of the Board of National Councillors of the National Highways Association, and Charles Henry Davis, President of that organization.

COMING MEETINGS

May 10-12—Michigan State Good Roads Association— Annual meeting, Battle Creek, Mich. Secretary, A. A. Anderson, Hastings, Mich.

May 31-June 2—New York State Conference of Mayors.— Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

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June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-July 1—American Society for Testing Materials— Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association— Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

American Road Builders' Association

At a meeting of the Board of Directors of the American Road Builders' Association, held at the Hotel Astor, New York, N. Y., on Thursday evening, it was decided to hold the 1917 convention of the association in Mechanics' Hall, Boston, Mass., during the week beginning February 5, 1917.

The decision was reached after carefully weighing the advantages of several other cities and the invitation of the City of Boston, as represented by Mayor Curley and the Boston Chamber of Commerce, was finally accepted because it was felt that Boston is to some extent the center of road building activities, owing to the advanced position occupied by Massachusetts in the road building field.

The facilities afforded by Mechanics' Hall for a convention of this character are described as being little short of ideal. The hall is well lighted and heated and contains ample floor space for almost any number of exhibitors. It is within easy walking distance of the leading hotels and the convention hall is conveniently located over the main exhibition hall.

This will be the 14th annual convention of the A. R. B. A., with which will be combined the Seventh American Good Roads Congress and the Eighth National Good Roads Show of Machinery and Materials.

State-Wide Road Meeting in Michigan

Plans are being made for a state-wide good roads meeting to be held at Battle Creek, Mich., May 10, 11 and 12, under the auspices of the Michigan State Good Roads Association, which will hold its annual meeting at the same time. It is expected that each county of the state will send delegates and that the various good roads organizations of the state will be represented.

The program has not yet been completed, but it is expected that addresses will be made by Governor Ferris, State Highway Commissioner Rogers, and Edward N. Hines, Chairman of the County Road Commission of Wayne County, Mich.

It is planned to have an exhibition of road making machinery and materials. In this connection the United States Department of Agriculture has tendered an exhibit of models of road construction.

North Carolina Good Roads Association

The annual convention of the North Carolina Good Roads Association will be held at Wilmington, N. C., June 20, 21 and 22. Plans are being made by the Board of County Commissioners of New Hanover County, N. C., and the Chamber of Commerce of Wilmington, to insure its success.

The program has not been completed, but it is expected that one day will be designated as "Governor's Day," when Governor Locke Craig will be present.

MEETING

Florida State Good Roads Association

The 19th annual convention of the Florida State Good Roads Association was held at St. Augustine, Fla., March 23 and 24, with F. O. Miller, President of the organization, presiding.

Edward Scott, Chairman of the Florida State Road Department, was one of the principal speakers, his subject being "Methods of the Florida State Road Department, and Work Contemplated."

A committee of three was appointed by the President to confer with the State Road Commission with regard to the establishment of a state brick plant.

President Miller and Secretary J. P. Clarkson declined reelection and the following officers were chosen to serve during the ensuing year:

President, A. W. Corbett, St. Augustine; Vice President, Dr. J. P. Benton, Gainsville; Treasurer, H. G. Aird, Jacksonville; Secretary, S. T. Kidder, St. Augustine.

It was decided to hold the next annual meeting at Tallahassee at a date to be set by the Board of Governors.

PERSONAL NOTES

Charles P. Light has resigned as Field Secretary of the American Highway Association to take effect May 1. He will be associated with the Fidelity Mutual Life Insurance Co., in a managerial capacity, with headquarters at Washington, D. C.

Amos F. Schaeffer, Consulting Engineer in Charge of Sewers for the Borough of Manhattan, New York City, has been promoted to the position of Consulting Engineer of the borough, to fill the vacancy caused by the resignation of Ernest P. Goodrich, noted in the preceding issue of "Good Roads."

Percy H. Wilson, M. Am. Soc. C. E., Secretary of the American Portland Cement Manufacturers' Association from 1908 until 1915, has gone into private practice with offices in the Land Title Building, Philadelphia, Pa. He will specialize on cement, concrete, concrete roads and similar work.

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Notice to discontinue subscription should be sent to the New York office.

Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Proposed Bridge at Watertown, New York, Would Eliminate Grade Crossings

Plans are well advanced for the construction of the Court Street Bridge at Watertown, N. Y., the cost of which will be about $165,000, according to estimates.

The city has already authorized a bond issue to take care of its share of the cost, which will amount to about $82,500. The bridge was projected a year ago but was held up owing to a lack of state funds for grade crossing elimination, under which the proposed structure comes. State funds are now available for this purpose and the New York Central Rialroad, it is understood, has indicated a willingness to assume a share of the cost.

Four New Bridges Soon to Be Opened in Chicago, Illinois

According to present plans, four new bridges across branches of the Chicago River in Chicago, Ill., will be opened for traffic by July 1. The aggregate cost of the structures will be approximately $1,270,000.

The Montrose Avenue bridge, which will cost $70,000, is completed with the exception of the approaches, and will be ready for the public about the middle of next month.

The Belmont and Webster Avenue bridges will be opened, probably, early in June. These are of the bascule type and cost about $300,000 each.

Late in June the new Lake Street bridge, now used only for elevated traffic, will be opened for street traffic as well. This structure cost $600,000 and its opening has been delayed by the construction of a viaduct over the tracks of the Chicago, Milwaukee & St. Paul Railroad.

In addition to these bridges, construction of the new Monroe Street bridge, which will cost $350,000, will be started at once and the bridge is expected to be ready for use by the latter part of November. Half of the cost will be borne by the Union Station Co.

The Van Buren Street bridge, which has been ordered out by the government, will be removed before the end of the year and a new bridge will be built at a cost of $550,000.

Plans for a new bridge at 12th Street which will cost $652,000, have been completed, as have those for the new LaSalle Street bridge and the proposed bridge at Wells Street. The Bridge Department is working on drawings for a bridge to connect Franklin and Orleans Streets.

Pennsylvania Highway Department to Build Roads in Three Counties

The Pennsylvania State Highway Department plans to receive bids May 15 for the construction of state highways in Delaware, Chester and Montgomery Counties. These roads will be constructed under the department's new specifications.

One section of this construction will be 4,390 ft. of bituminous concrete in Whitemarsh Township, Montgomery County, and another will be 4,250 ft. of vitrified block in Nether Providence Township, Delaware County.

The remainder of the construction is on what is known as the Old Baltimore Pike, for which citizens of Delaware and Chester Counties contributed $70,000 to the state. Four sections, with an approximate length of 11.75 miles, are advertised. On three of these alternate bids are asked for reinforced cement concrete or bituminous and reinforced concrete construction.

Police Record Shows 22,540 Persons Hurt in New York City Streets

According to official figures compiled to form a part of the annual report of the New York, N. Y., Police Department, 22,540 persons were injured by accidents in the city streets during 1915. Of this number, 659 persons died.

The report states that 23 persons were struck by railway trains, of whom 13 died; 1,771 were struck by street cars, of whom 77 died; automobiles struck 4,865 persons, of whom 177 died; 1,212 were struck by delivery motor vehicles, of whom 105 died, and motorcycles injured 377 persons, none of whom died.

Passenger horse drawn vehicles injured 246 persons and killed 3; horse-drawn trucks or wagons injured 2,341 persons and killed 100; 16 persons were injured by saddle horses, and bicycles injured 349 persons and killed 3. Other vehicles killed one person and injured 71.

To falls and miscellaneous injuries suffered while riding on, boarding or alighting from vehicles are due 3,026 injuries, of which 47 were fatal. Nine persons were killed, while stealing rides and 304 were injured. Collisions between vehicles were responsible for the death of 41 persons and the injury of 2,387. In other vehicular accidents 19 persons were killed and 554 were injured. Runaways caused the death of 13 persons and injuries to 408.

Other accidents on the list were falls, 24 dead and 2,981 injured; hit by falling objects, 1 dead, 583 injured, and miscellaneous accidents, 16 dead and 796 injured.

Of the 659 persons killed 106 were under six years. Of these children 42 were killed by being run over by horse-drawn trucks or wagons; 27 were run over by automobiles, and 15 by motor delivery wagons. There were 149 females in the list of dead and 510 males.

The greatest number of accidents seems to have occurred during the summer months. There were 1,580 accidents in January, 1,359 in February, and then the figures increase several hundred a month until July, when there were 2,291 accidents. Then, with the exception of September, when there were more accidents than in August, there is a gradual decline each month until for December the figure is 1,541.

Montgomery County, Pennsylvania, to Build Two Bridges

The County Commissioners of Montgomery County, Pa., are planning the construction of two bridges over the Schuylkill River, one at Royersford, which will be an inter-county structure, and the other at Conshohocken.

Present plans for the latter bridge involve an estimated expenditure of approximately $250,000, and it is intended that the structure shall eliminate grade crossings in Conshohocken and West Conshohocken. The present bridge at this point has been pronounced in a dangerous condition.

New York State Secures Verdict in Suit for Highway Fraud

The State of New York has secured a verdict and obtained a settlement in a civil suit for highway fraud and this action furnishes a basis for a number of suits against various contractors. The actions are brought for the purpose of recovering moneys which various investigators in the last few years claim was obtained by fraud in the construction of state highways.

In the case recently settled it was claimed by the State Attorney General's Department that, although the road had been accepted by the state and the defendants paid in full, there was a conspiracy between the defendants and the state inspectors.

The amount involved in suits already instituted or in contemplation is understood to be more than $100,000.

State Aid Road Construction in Six Illinois Counties

The Illinois State Highway Department will receive bids next Wednesday for the construction of eight sections of state aid road, located in six counties.

A total of approximately 16 miles of roads of various types is involved in the work, and the cost is estimated at $168,331.21.

The different items are shown in the following table, the estimated cost being exclusive of cement furnished by the state.

County	Type	Length, Ft.	Estimated Cost
Adams	W. B. Macadam	6,910.0	$ 18,036.67
Coles	Mono. Brick	7,100.0	15,145.00
Cook	Concrete	8,142.2	22,488.56
Cook	"	14,077.0	31,547.88
Cook	"	15,331.5	34,627.80
DeKalb	"	17,888.0	24.950.40
Ford	Gravel	13,522.0	16,188.90
Wabash	"	3,820.0	*5,416.00
Total		86,790.7	$168,331.21

*No cement furnished by state.

Highway Commissioner Cunningham of Pennsylvania Dead

Robert J. Cunningham, State Highway Commissioner of Pennsylvania, died suddenly on April 26, at his residence, in Sewickley, Pa.

Commissioner Cunningham suffered an attack of acute indigestion while returning to his office at Harrisburg, Pa., April 4, from a trip through Cambria County. While his condition was recognized as serious, it was not regarded as critical and, after resting two days at his hotel in Harrisburg, he was taken home by his son. Reports of an encouraging nature had been received by the State Highway Department until the Commissioner suffered a sudden turn for the worse and the end came unexpectedly.

Mr. Cunningham was born at Elizabeth, Pa., April 5, 1860. His family moved to Pittsburgh in 1863 and to Sewickley in 1871. He was educated in the public schools and in Dickson's and Donthett's Academies.

When he was 16 years old, Mr. Cunningham became a pilot between Pittsburgh and Louisville on river boats owned by his father, who was engaged in the coal business.

THE LATE ROBERT J. CUNNINGHAM,
State Highway Commissioner of Pennsylvania.

Upon his father's death in 1878 he left this work and entered the newspaper business as shipping clerk on the Pittsburgh "Times," now the "Gazette-Times." In 1881 he took charge of the press rooms and machinery department of the Pittsburgh "Leader," later becoming a special writer and musical critic for the Sunday edition of that paper.

Mr. Cunningham was elected Comptroller of Allegheny County, as an independent Republican, in the fall of 1902. He served in that capacity until 1906, when he was elected to the State Senate, from which he resigned in 1908. In that same year he was re-elected Comptroller and served continuously until he resigned to accept the appointment as State Highway Commissioner. Besides serving as Comptroller of Allegheny County and as State Senator, Mr. Cunningham was twice elected Chairman of the Republican Committee of Allegheny County.

Mr. Cunningham was a member of the Methodist Episcopal

Church of Sewickley, Pa., which he joined in 1875. He was married in 1890 to Miss Edith Gilmore. He was a member of the Masons and the Elks, and of the Duquesne, Edgeworth, Americus and the Young Men's Republican Tariff Clubs. He was president of the latter organization for two years. He was a director of the First National Bank of Sewickley.

He was appointed State Highway Commissioner of Pennsylvania by Governor Brumbaugh in April, 1915, and his work in that office has been such as to place the State Highway Department high in the public esteem. He perfected an organization of the department along business lines and was regarded as a personal friend by everyone connected with the department.

The funeral was held on Friday and was attended by the following officials of the department: Joseph W. Hunter, First Deputy State Highway Commissioner, who automatically becomes Acting Commissioner; George H. Biles, Second Deputy State Highway Commissioner; W. D. Uhler, Chief Engineer; W. R. Main, Auditor; Howard W. Fry, Chief Clerk, and W. R. D. Hall, Statistician.

Floral tributes were sent by the employees of the central office of the State Highway Department and by the assistant engineers in charge of districts throughout the state. The deparment was closed all day on Friday and the flag on the State Capitol was placed at half-staff.

Road System Changes Recommended in New Castle County, Delaware

The Chamber of Commerce of Wilmington, Del., has made public a report submitted by a commission of engineering experts who have been making a survey of the roads and the system of road construction and maintenance in New Castle County, Del.

The commission, which was retained by the Levy Court Committee of the Chamber of Commerce, consists of Prof. Arthur H. Blanchard, Columbia University, New York, N Y., George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York City, and Henry G. Shirley, Chief Engineer of the Maryland State Roads Commission.

A summary of the findings of the commission included, among other things, the opinions that, in general, the cost per mile of highways examined is excessive and above the normal prices in adjoining states; that organization is not such as to produce best results; that sufficient attention has not been given to preliminary investigations, surveys, etc., before advertising for proposals; that specifications have been so indefinite at times as not to permit intelligent and economical bidding, and that advertisements have not been given such publicity as to secure wide competition.

Among the recommendations of the commission it was stated that interstate and intrastate trunk highways should be constructed of cement concrete or bituminous concrete pavements on cement concrete foundations, and that such pavements be 18 ft. wide. On other roads of the first class the commission recommended that construction be of broken stone, with bituminous surface, cement concrete or bituminous concrete, the selection of type being dependent upon thorough preliminary investigations and the width to be from 14 ft. to 18 ft.

It was advised that all appointees and employees should be under the direct supervision of an engineer to be known as the New Castle County Highway Commissioner, who should have charge of all highway work coming under the jurisdiction of the state and Levy Court; that the positions of county road engineer and county supervisor of roads be abolished and their duties taken over by the highway commissioner; that the Governor should appoint for four years the highway commissioner who should be an experienced civil engineer and not necessarily a resident of the county; that the highway commissioner should appoint an assistant engineer and also a superintendent of construction for each highway contract and that the highway commissioner should investigate and recommend a system of highways.

The report also recommended that advertisements for road contracts should be inserted in technical publications as well as newspapers; that all bids should be submitted on the same items and the award made to the lowest responsible bidder.

It was also recommended that an annual financial statement be prepared by the highway commissioner, setting forth detailed accounts of construction costs and maintenance, and the character of the work done and data concerning the traffic over the road; that where practicable, maintenance work be let under contract and performed under adequate specifications and that an annual detailed report be published.

Street Paving Program in Findlay, Ohio

The 1916 street paving program for Findlay, O., includes the paving of 15 streets and the cost, according to estimates prepared by City Engineer U. K. Stringfellow, will be about $130,000.

During 1915, the paving in Findlay covered 12 streets and the cost was $157,558. One of these was Main Street, the cost of which was $94,000.

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Road Builders' Institute at the University of Washington

A Road Builders' Institute will be held at the University of Washington, Seattle, Wash., May 1 and 2. The sessions will be opened with an address of welcome by Dr. Henry Suzzallo, President of the University.

Other features of the program for the first day will be papers on the following subjects: "Road Plans and Specifications," C. R. Ege, Spokane, former Assistant Engineer, State Highway Commission; "Road Building Materials of the State," Henry Landes, Dean, College of Science; "The County Engineer's Viewpoint," Hans Mumm, Jr., City Engineer, Everett; "The Work of the State Highway Department," George F. Cottrell, Chief Engineer; "Highway Bridges," A. H. Fuller, Dean, College of Engineering; "The Highway Engineer and the Public," H. W. Boetzkes, Assistant State Highway Engineer; "Brick Roads and Pavements," A. H. Dimock, City Engineer, Seattle; "Road Bitumens," Dr. H. K. Benson, Professor of Industrial Chemistry; "Road Work in Snohomish County," R. H. Thomson, Consulting Engineer, Seattle.

The program for the second day includes these papers: "The Contractor's Bond," W. V. Turner, State Attorney General; "Concrete Pavement," C. N. Reitze; "Mysteries of Concrete Road Construction," W. H. Reed, President, State Association of County Commissioners. In the afternoon there will be a paper entitled "Tests of Highway Material," by William F. Allison, Professor of Municipal and Highway Engineering, and a student thesis, "Tests of Concrete," by Thomas Driscoll and Henry Zimmerman.

A meeting will be held May 9 at Cartersville, Ga., of women representing the counties between Atlanta, Ga., and Chattanooga, Tenn., who are interested in the construction of the Dixie Highway. The meeting will be under the auspices of the Cherokee Club of Cartersville and will be devoted to the question of beautifying the eastern and western divisions of the highway between Chattanooga and Atlanta.

The 24th annual meeting of the Society for the Promotion of Engineering Education will be held at the University of Virginia, University, Va., June 19-22. Prof. F. H. Constant, Princeton University, Princeton, N. J., is Chairman of the Administration Committee.

MEETINGS

Southern Central Kentucky Association

The Southern Central Kentucky Good Roads Association was organized at a meeting of delegates from ten counties held at Somerset, Ky., April 15, at the invitation of the Somerset Board of Commerce.

Officers of the new association were elected as follows: President, J. F. Jasper, Pulaski; Vice President, Dr. S. F. Parker, Pulaski; Secretary, C. C. Thomas, Somerset; Treasurer, William Hurst, Rockcastle.

The meeting was addressed by R. C. Terrell, State Roads Commissioner of Kentucky, who urged cooperation with the State Roads Department.

Another meeting for the adoption of a constitution and by laws will be held at Somerset on May 13.

The counties represented in the association are Pulaski, Lincoln, Rockcastle, Laurel, Whitley, McCreary, Wayne, Casey, Russell and Scott.

The Ohio Paving Brick Manufacturers' Association elected the following officers at a meeting held April 6 at Columbus, O.; President, W. N. Alderman, Athens; Vice President, F. L. Manning, Portsmouth; Treasurer, Charles J. Deckman, Cleveland.

PERSONAL NOTES

W. T. Allen has been appointed Street Commissioner of Augusta, Me.

K. C. Kastberg has been appointed City Engineer of Des Moines, Ia.

Caleb Berry has been appointed City Engineer of Centralia, Wash.

William Browning has been appointed Superintendent of Streets of Ilion, N. Y.

Rankin Duval has been appointed County Road Engineer of Scott County, Ky.

Charles B. Chickering has been elected Road Commissioner of Lancaster, Mass.

C. S. Woodward has resigned as County Road Engineer of Jessamine County, Ky.

E. C. Johnson has been elected Superintendent of Sewers and Highways of Newburyport, Mass.

S. N. Parker has been elected Commissioner of Streets and Public Utilities of Emporia, Kan.

John R. Graham has been elected Superintendent of Streets of Lynn, Mass., to succeed the late George M. McPheters.

Clifford B. Moore, consulting engineer, New York, N. Y., has been appointed a member of the Examining Board of City Surveyors, vice Edward P. Goodrich, resigned.

George W. White, County Surveyor of Jefferson County, Tex., has been appointed Road Engineer and will be in entire charge of the road work to be done under a recent $200,000 bond issue.

NEWS OF THE TRADE

J. W. Stanchfield, contractor, Seattle, Wash., will remove his business to Astoria, Ore.

Lucius E. Allen, consulting engineer, Belleville, Ont., has moved into new offices in the Canadian Bank of Commerce Building.

The American Clay Machinery Co., Bucyrus, O., has issued a colored sketch, 25 x 42 ins., of the American-Haigh continuous kiln for burning paving brick and other earthenware products.

The General Electric Co., Schenectady, N. Y., has issued two new catalogs dealing with street lighting. One covers brackets and center span fixtures for Mazda lamps and the other deals with Novalux street lighting units for Mazda series lamps.

A folder entitled "Stop That Waste" has been issued by the Blaw Steel Construction Co., Pittsburgh, Pa. It deals with Blawforms for concrete road, curb, gutter and sidewalk construction, is printed in two colors and illustrated with half tones.

The Kanawha Paving Co., Charleston, W. Va., has been incorporated to manufacture paving brick, tile and other earthenware products. The company has an authorized capital of $5,000 and the incorporators are Samuel Glover, W. D. Weaver, T. K. Weaver, H. L. Kimberlin and Berkeley Miner, Jr., all of Charleston.

The District of Columbia will open bids about June 1 for asphalt resurfacing. The contract may be for one to five years in the discretion of the District Commissioners. It is estimated that a 5-year contract would call for an expenditure of about $800,000.

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"GOOD ROADS DAYS" IN PENNSYLVANIA—AND ELSEWHERE

On other pages of this issue considerable space is given to the state-wide "good roads day" in Pennsylvania." Before the close of the present road building season several other states and some smaller units of government will have held similar days, and it may be well, at this time, to consider briefly some of the outstanding features of the institution.

The "good roads day" has grown rapidly in popular favor in the past few years. In a measure, the idea of setting aside one day annually for volunteer labor on the highways is a reversion to the old plan of "working out" road taxes. If it were wholly that it would be a step backward, for the so-called labor tax has been tried and found impracticable and inefficient under the conditions now obtaining in most parts of this country. But the "good roads day" and the day or days set aside for road work under the old system differ in their chief object. The purpose of the former plan was to get certain work done. The chief end of the modern good roads day—as we understand it—is to arouse interest in road improvement.

Bearing in mind this difference in purpose, the difficulty of accurately estimating the value of the good roads day will be appreciated. It must be judged by intangible results, not by concrete, readily measured accomplishments. Then, too, the physical conditions, the state of public opinion and a multitude of other factors must be given due weight.

If actual work done on the roads were the chief object of the good roads day, it could not be regarded as worth while in the majority of instances. Although some of the simpler types of roads can be vastly improved by the volunteer labor of men with no qualifications except a willingness to do their best and the physical ability to handle a pick and shovel, much better results would be secured by a force of skilled workmen under competent supervision. In fact, the construction and maintenance of many modern roadway surfacings and practically all pavements make it necessary that at least a part of the force consist of workers having considerable skill and experience. The very general substitution of the cash tax for the labor tax during recent years indicates the extensive acceptance of this argument.

At the same time it must be remembered that in an occasional case similar to those alluded to, a very considerable amount of valuable work is done in the actual construction, repair or maintenance of country roads. From reports on good roads days held in various sections—especially in the rather sparsely settled portions of the country—it seems that the day's work not infrequently brings a very substantial return that can be measured in dollars and cents.

As a means for molding public opinion, the good roads day appears to have proved entirely successful where it has been tried. In the first place, it brings the taxpayers—the people to be reached—into actual contact with the work and makes road improvement, for at least one day, their first interest. In many states which have good roads days the state, county and local officials travel about from place to place, so giving the citizens an opportunity to know the men who have in their control the expenditure of the public funds. Through the addresses made by officials and others and such printed matter as may be distributed, much information on roads and road work is disseminated and the arguments for whatever action seems desirable are made.

Good roads days, therefore, though not adapted to the needs of all sections are doubtless of very great value in those states or portions of states where local conditions are favorable to that particular method of promoting highway improvement. Some two and a half years ago—before the good roads day idea had been so generally accepted as now—it was pointed out in these columns that if any state by means of the good roads day could so mold popular sentiment as to bring about the enactment of better road laws, the plan would be sufficiently justified. The workings of the plan since that time, we believe, have borne out that argument.

THE 1916 ROAD BUILDING SEASON

By the time this number of "Good Roads" reaches its readers road work will be well under way. The conditions in general are such that any attempt at extensive predictions is even more dangerous than usual, but at the same time a few particular features may be forecasted with some degree of certainty.

In the first place, it seems likely that there will be a larger amount of road and street work than was done last season. Although no reliable definite figures are at hand, a canvass of the available data points to increases over 1915 in many places and decreases in comparatively few.

While a sufficient amount of work to keep contractors busy may reasonably be expected, it seems certain that road builders will have to meet some serious difficulties in the prosecution of their work. Delays in the delivery of many materials are certain unless the transportation situation soon changes, and increased prices will probably prevail to some extent. Many contractors expect that securing and keeping labor, which last year was very difficult in some sections, will be troublesome again and that somewhat higher wages will have to be paid.

In spite of these factors, the present outlook is distinctly good. There is plenty of work to be done and the difficulties to be expected are such that experienced contractors who are well equipped can make the season successful.

TRADE LITERATURE

The appearance of several exceptionally well prepared catalogues and other examples of trade literature within the past few months has suggested again the value of such literature as a part of the engineer's library.

It is doubtful if engineers and others engaged in engineering work fully appreciate how valuable such literature really is. Many catalogues issued by machinery manufacturers, for instance, are much more than descriptions of equipment. They often contain convenient tables, short treatises on the use and care of equipment, up-to-date and reliable information on the methods of prosecuting specific kinds of work, and miscellaneous data that are sometimes particularly useful. Booklets containing matter such as that outlined are often printed on very good paper, bound in cloth and thoroughly indexed. In addition, they are usually of the convenient handbook size.

In the road building field there are many such booklets, and in almost every one of them much of value can be found. Notices of these catalogues and booklets are published in "Good Roads" under the caption "Trade Notes," and they are also frequently mentioned in advertisements. As a rule they can be obtained free, although in a few instances a merely nominal price is charged, and road builders will do well to take advantage of these opportunities to add to their libraries.

WHAT IS A PAVEMENT?

What types of roadway surfacings should properly be classified as pavements?

This query has been suggested recently by an examination of data on street paving in a number of cities. The figures referred to included statements showing the total mileage of paved streets and the mileage of each type of surfacing in each of a number of cities. Some street officials classed streets surfaced with gravel and water bound macadam as paved streets, while others excluded these two surfacings and, in a few cases, others.

The dictionary definition of a pavement is: "That with which anything is paved; a floor or covering of solid material, making a hard and convenient surface for travel; a paved road, sidewalk, or other surface." The verb, pave, is defined as follows: "To lay or cover with stone, brick, or other material, so as to make a firm, level, or convenient surface for travel; to floor with brick, stone, or other solid material; to cover as a pavement." These definitions are sufficiently broad to permit the inclusion of gravel, water bound macadam, sand-clay, and various other surfacings as pavements.

On the other hand, the American Society of Civil Engineers' Special Committee on Materials for Road Construction and on Standards for their Test and Use has defined a pavement as follows: "The wearing course of the roadway or footway, when constructed with a cement or bituminous binder, or composed of blocks or slabs, together with any cushion or binder course." Under this definition gravel, water bound macadam and some other types of surfacings would not be pavements.

While the dictionary definition and the one proposed by the committee are not comparable, they represent exactly the difference of opinion that apparently exists among street officials and engineers. Doubtless the committee's definition merits the greater consideration, for it was made by experts while the dictionary definition probably was not. Certainly it seems to represent the current usage of engineers and technical writers.

Although the question is perhaps of minor importance, it is worthy of consideration, for the subject of road building terminology needs standardization. Discussion of the matter from our readers will be welcomed.

June 1 has been Designated as Road Marking Day on the Dixie Highway between Louisville and Nashville. It is stated that notices have been sent to all of the counties in the Louisville-Nashville division directing them to secure the necessary markers from the Dixie Highway Association at Chattanooga and to be ready to put them up on the day designated. It is reported that other divisions are preparing to follow the example of the Louisville-Nashville division by observing a special marking day early in June.

A Bituminous Gravel Surface will carry as heavy traffic and will wear at least as long as bituminous macadam, according to W. R. Farrington, Division Engineer, Massachusetts Highway Commission. This opinion was expressed by Mr. Farrington in a paper entitled, "Sand and Oil Roads and Surfaces," presented recently before the Boston Society of Civil Engineers and printed in the February number of the "Journal" of that organization. In the paper the author reviewed Massachusetts practice in the construction of sand and oil surfaces, touching briefly upon bituminous gravel roads. Either bituminous gravel or sand and oil gives excellent results when used for resurfacing old water bound macadam roads, according to Mr. Farrington.

Salient Features of Highway Work in Philadelphia, Pennsylvania, During 1915

In the report of the Bureau of Highways and Street Cleaning of Philadelphia, Pa., for the year 1915, William H. Connell, Chief of the Bureau, presents an interesting review of the year's work and detailed statements regarding a number of important street and road projects of the city. The space available here does not permit a complete review of the report, but in the following paragraphs certain of the more important phases of the work of 1915 and previous years are touched upon briefly, with especial attention to some of the work which has not been described in previous issues of "Good Roads."

Early in the report Chief Connell calls attention to the importance of the city's streets. The streets, roads, bridges and sewers under the care of the bureau represent a valuation of approximately $115,000,000, he states, and their upkeep is one of the most important matters in the bureau's work. In discussing this, it is estimated that the cost per vehicle, for the renewal of parts and for the ordinary wear and tear caused by travel over poor pavements, would amount to at least $40 per year, and that when the number of vehicles of all classes using the streets every day is considered the neglect of proper upkeep of the pavements would result in a cost of about $1,500,000 annually. During the last year the upkeep work of the bureau included the repavement, repair and cleaning of 1,655.74 miles of streets and roads at a cost of $3,867,594.26. Adding to this the cost of newly constructed pavements, the maintenance of bridges and sewers, snow removal and miscellaneous work under the jurisdiction of the bureau, brings the total expenditure for the past year to $6,003,632.91.

THE NORTHEAST BOULEVARD, PHILADELPHIA, PA.—CENTER DRIVE PAVED WITH BITUMINOUS CONCRETE ON A CEMENT CONCRETE FOUNDATION, WATER BOUND MACADAM SHOULDERS; SIDE DRIVES ALSO PAVED WITH BITUMINOUS CONCRETE ON CEMENT CONCRETE FOUNDATIONS.

Prior to 1719, according to the report, all of the city's streets were unpaved. During that year, however, brick was laid on some of the foot pavements and stone on some of the cartways. The first street regularly paved was Second St. between Market (then High) St. and Chestnut St. The need of proper pavements began to be realized as the city grew and in 1750 the Grand Jury called attention to the necessity of paving to remedy "the extreme dirtiness and miry state of the streets." Not much was done until 1761 when the city raised $50,000 by means of a lottery and used some of the money for paving Second St., between Market and Race Sts., with what was called "pebbles" in those days and is now known as cobble pavement. The systematic cleaning of the streets began about 1765 when an official designated as a "scavenger" was appointed to supervise the cleaning of the streets once a week. The first curbstones were laid on Water St., between Market and Arch Sts., about 1786. The first wood block paving laid in Philadelphia was put down in 1835. At about that time considerable experimentation with this kind of paving was carried on, but because of poor foundations and the lack of proper methods of preserving the wood the work was attended with very little success. It is stated that in 1843 a committee of the Franklin Institute published a report opposing concrete as a pavement foundation on the ground that it was "a barrier against the necessary access to the underground works of the city."

By 1884 Philadelphia had about 535 miles of paved streets, with an area of over 9,700,000 square yards. At that time 93 per cent. of the pavement was cobble while at present, cobble amounts to less than 0.3 per cent. of the entire pavement of the city. At the same time (1884) asphalt pavements amounted to 0.33 per cent. of the total yardage of the city, while they now amount to 49.7 per cent.

At the close of last year there were 1,655.74 miles of highways in the City of Philadelphia of which 1,467.29 miles were improved pavements and country roads and the remainder were earth roads. Of the 1,467.29 miles of highway classed as improved pavements and country roads, 1,126.61 miles consisted of hard pavements of various kinds. This mileage, which in area amounted to 17,873,619 sq. yds., comprised pavements as shown in Table I.

The 340.68 miles of highway classed as country roads had a total area of 3,966,399 sq. yds., divided as shown in Table II.

An important part of the bureau's operations is the work performed by the municipal forces. During the year the keeping of cost data of work done by city labor was continued and amplified and the reorganization of the forces continued, with a resulting increase in efficiency. As evidence of this the report cites a reduction of 1 ct. per sq. yd. in the cost of bituminous surface treatment, amounting, for the total work done, to $15,740.14 during the year, and a saving of $80,000 in repair work, making a total saving in 1915 of $95,740.14.

In addition to the work done by the municipal forces the work under the jurisdiction of the bureau during 1915 included 835 contracts for grading, the construction and maintenance of streets and roads, the collection and disposal of garbage, ashes and household waste, street cleaning, and the maintenance of bridges and sewers. The value of these contracts amounted to $7,849,568.32, of which $5,027,854.05 was expended during the year. This expenditure, with that for work done by the municipal forces in the maintenance of roads and streets, and bridges and sewers, made a total of nearly $6,800,000 actually expended by the bureau in construction and maintenance during 1915. The engineering and overhead charges, including transportation and all office expenses, amounted to 5.26 per cent., bringing the total expenditure up to $7,175,930.80. Bids were also received on work, which was not started, to the value of $1,025,381.21.

During the year 112.73 miles of highway construction was carried out by the bureau. This work comprised the building of roads and pavements as shown in Table III.

The work of repaving was continued during 1915 and at the end of the year the majority of streets adjoining schools and hospitals had been provided with noiseless pavements. During the year over $1,000,000 was made available for repaving work, this making it possible to place under contract many of the most important repaving jobs. Included in the repaving work of 1915 were portions of South St., Chestnut St., Fairmount Ave., Spring Garden St., Chelten Ave. and Wayne Ave.

In 1912, according to the report, almost all of the country roads in the city were in very bad condition. As the funds for country road work are always limited, the bureau adopted the policy of placing the more important through routes in first-class condition, and expending on the less important routes only enough to keep them in a safe condition until funds were available for improvement. During 1912 the most important through routes were improved and during 1913 and 1914 the remainder of the important routes and many of the secondary roads were improved. The work done so reduced the cost of maintenance as to make available for new work practically all of the funds recently appropriated, with the result that at the end of 1915 practically

1.—Machine Broom Cleaning Surface of Roadway to be Treated

2.—Hand Brooming, Following Sweeping With Machine Brooms

3.—Applying the Bituminous Material With Pressure Distributor

4.—Spreading Stone Chips After Applying the Bituminous Material.

SUCCESSIVE STEPS IN BITUMINOUS SURFACE TREATMENT WORK PERFORMED BY THE BUREAU OF HIGHWAYS AND STREET CLEANING, PHILADELPHIA, PA.

all of the macadam roads in the city were in good condition. In 1914 the bureau adopted the plan of laying concrete bases for bituminous roads instead of laying the bituminous wearing surfaces on old macadam. This policy was continued during 1915, as it was considered that it had been definitely demonstrated that such construction, although from 10 to 15 cts. per sq. yd. greater in first cost, would sufficiently increase the life of the pavement and reduce the cost of renewing bituminous surfacings to ultimately effect a considerable saving.

The application of bituminous surface treatments on water bound macadam roads was continued during the year. When the work was started only a few of the macadam roads were in proper condition to receive such treatment, but the roads have since been repaired, and at present nearly all of the water bound macadam roads in the city have been surface treated with bituminous materials. Because of more efficient methods of doing the work and the smaller amount of material required for retreatment, the cost was reduced from 7.3 cts. per sq. yd. in 1913 to 5.8 cts. per sq. yd. in 1914, and further to 5.03 cts. per sq. yd. in 1915. During 1915, 149.1 miles of road were given bituminous surface treatments, and 111 miles were treated with dust layers.

TABLE I.—YARDAGES OF VARIOUS PAVEMENTS IN PHILADELPHIA, PA.

Kind.	Amount, Sq. Yds.
Sheet asphalt	8,071,438
Granite block	6,505,395
Vitrified block	2,723,131
Wood block	254,716
Slag block	78,071
Asphalt block	68,639
Rubble	60,235
Cobble	57,752
Cement and granolithic	54,242

TABLE II.—YARDAGES OF COUNTRY ROADS IN PHILADELPHIA, PA.

Kind.	Amount, Sq. Yds.
Water bound macadam	2,771,132
Bituminous pavements	1,163,653
Concrete roads	28,090
Granite block on hillsides	3,524

TABLE III.—MILEAGES OF ROAD BUILT IN PHILADELPHIA, PA., DURING 1915.

Bituminous roads	34.80
Sheet asphalt	27.06
Grading	21.15
Water bound macadam	18.35
Vitrified block	5.41
Wood block	3.17
Cement concrete roads	1.40
Granite block	1.39

Considerable space is given in the report and in the appendices to the concrete service test road on Oxford Pike and to the Byberry and Bensalem service test road. The Oxford Pike service test road is a little over two miles in length and is paved to a width of 18 ft. with concrete. It is divided into sections each 2,250 ft. long in which different concrete mixtures were used. Each of these sections is again subdivided into two sections, one 1,050 and the other 1,200 ft. long. The 1,050-ft. sections have no additional surfacing, while the 1,200-ft. sections, each divided into four parts, are covered with bituminous wearing surfaces. Four materials were used for these surfacings, a different one being applied on one portion of each 1,200-ft. section. An illustrated description of this work was printed in a previous issue of "Good Roads." ["An Experimental Concrete Pavement Under Construction in Philadelphia," "Good Roads," Nov. 7, 1914, p. 107.]

VIEW ON A TYPICAL IMPROVED COUNTRY ROAD IN PHILADELPHIA, PA.—BITUMINOUS CONCRETE ON CEMENT CONCRETE FOUNDATION, CONCRETE CURBS.

The Byberry and Bensalem service test road consists of 26 sections, each with a different pavement. The road was built in 1912 and 1913 and was described in "Good Roads" for Dec. 7, 1912. ["Service Test Roadway in Philadelphia, Pa.," "Good Roads," Dec. 7, 1912, p. 260.]

Among other important phases of the work taken up in the report are the planning boards installed in the bureau, the inspection of materials, the specifications of the bureau and the issuing of permits for street openings and similar work. The planning boards, by means of which the engineers of the department are enabled to follow the progress of street work, have been described previously. ["Planning Boards Installed in the Bureau of Highways and Street Cleaning." By William H. Connell, "Good Roads," Sept. 11, 1915, p. 168.]

Much of the work of inspecting materials was carried on along the general lines followed during the preceding two years. An innovation, however, was made in the inspection of creosoted wood blocks at the preserving plants by inspectors in the employ of the bureau. Another innovation was made in the inspection of bituminous materials for use in surface treatments. During last year the bureau specified that an inspector should be present during the entire process of producing and combining the materials used, thus making it possible to secure samples of the ingredients as well as of the completed mixtures, and also to determine the methods and the proportions of combination. The inspectors performed at the plant or refinery such tests as were necessary to control the general character of the products and complete tests on both

A PORTION OF THE OXFORD PIKE SERVICE TEST ROAD, PHILADELPHIA, PA.—PAVED WITH CEMENT CONCRETE, PLAIN AND WITH BITUMINOUS TOP.

the ingredients and the mixtures were made at the municipal laboratories.

In 1915 the Bureau of Highways combined the different specifications for paving and country road work into two general specifications. The first of these embraces all kinds of construction used on city streets, and the second, all kinds of construction used on suburban and country roads. The general clauses of the specifications of the Bureau of Highways and Street Cleaning, the Bureau of Surveys and the Bureau of Water have also been standardized and embodied in the specifications of the Bureau of Highways for the current year.

Several important projects which have been completed or on which progress has been made during the year are described at some length in the report. Among these are the Northeast Boulevard, South Broad Street Boulevard, League Island Park, the Plaza and the Parkway. Most of these special improvements have been mentioned from time to time in "Good Roads," and two of them, the Northeast Boulevard and the Parkway, have been subjects of special articles. An illustrated description of the Parkway, as then planned, was printed in 1914. ["A Proposed Parkway in Philadelphia, Pa.," "Good Roads," Aug. 1, 1914, p. 54.]

TYPICAL BUSINESS STREET IN PHILADELPHIA, PAVED WITH WOOD BLOCK ON CEMENT CONCRETE FOUNDATION, WITH CEMENT GROUTED GRANITE BLOCKS ON CONCRETE FOUNDATION IN TRACKS.

An illustrated description of the Northeast Boulevard was printed a few months later. ["Completion of the Northeast Boulevard in Philadelphia, Pa." "Good Roads," Dec. 5, 1914, p. 204.]

Considerable space in the report is devoted to the work of street cleaning. Of the total area of pavement in the city, an average of 9,873,152 sq. yds. per day was cleaned during 1915, making a total yardage cleaned during the year of 3,060,677,120. Some of the pavements are cleaned every day, some every other day, and the remainder every third day. The surfaced country roads are cleaned at intervals varying from one week to one month, the average area cleaned per day being 341,601 sq. yds. The total area of paved streets and country roads cleaned during the year was 3,166,574,000 sq. yds. In addition the work of the department has included the collection and disposal of ashes, rubbish and garbage.

The most noteworthy innovations in street cleaning work in 1915, according to the report, were the provisions for cleaning suburban streets and country roads, the use of automobile flushers and the specifying of a definite minimum of labor and equipment required for work in each district. Previous to 1915 the street cleaning work covered only the paved streets of the city, but in that year the work was extended to the suburban roads. The use of the automobile flushers was commenced in 1915 by requiring the contractors in two street cleaning districts to furnish automobile flushers. The work performed by these flushers was very carefully tested and was found to be highly efficient.

In connection with the street cleaning the work of snow removal was given considerable space in the report. The operation of the "snow alarm" is described in some detail. The operation of this plan was explained by Chief Connell at the Snow Removal Conference held in New York City on March 8 of this year, and an extract from his paper was printed in "Good Roads" for April 15, 1915.

The Influence of Physical Properties on the Qualifications of Road Building Rocks

In a recent bulletin of the United States Department of Agriculture, "Relation of Mineral Composition and Rock Structure to the Physical Properties of Road Materials," the author, E. C. E. Lord, Petrographer in the Office of Public Roads and Rural Engineering, sums up the conclusions to be drawn from investigations so far conducted. The following paragraphs from the bulletin, which is reviewed on another page of this issue, contain his summary:

"(1) Igneous and nonfoliated metamorphic rocks, owing to a preponderance of hard silicate minerals combined with greater uniformity in structure, are more durable than other road making materials, finer-grained varieties offering greater resistance to abrasion than coarse-grained types.

"(2) The resistance to wear of igneous and metamorphic rocks, containing an abundance of quartz, hornblende, augite, epidote, and garnet, is greater than that of similar rocks rich in mica, chlorite, serpentine, and calcite.

"(3) Foliated metamorphic rocks, owing to the parallel arrangement of their mineral constituents, are, as a rule, deficient in toughness, and therefore not well adapted to road construction.

"(4) Sedimentary rocks are usually deficient in wearing properties, except in the case of highly indurated sandstones, containing a moderate amount of siliceous clay, cement, and limestones or dolomites rich in quartz and having very little clay.

"(5) Rocks for road making break down under impact into fragments, the shape and physical character of which are conditioned by mineral composition and structure.

"(6) The effect of weathering is generally to lower the resistance to wear of road materials, owing to the development of soft, in part colloidal, products of alteration. Where the secondary minerals are harder and more crystalline the wearing properties of the rocks are proportionately increased.

"(7) The cementing value of road materials is conditioned chiefly by the colloidal products of rock decay and increases in a general way proportionately with these products, reaching a maximum in rocks free from quartz.

"(8) The slaking property of rock powders is dependent in the case of siliceous igneous and metamorphic rocks chiefly on the physical character of the primary mineral components, whereas in basic igneous rocks and sandstones it is caused to a large degree by colloidal products of rock decomposition."

The Route of the Lincoln Highway is discussed in a pamphlet recently issued by the Lincoln Highway Association under the title, "Report of the Directors of the Lincoln Highway Association on Route Efficiency." The pamphlet is 9x12 ins. in size, and consists of 12 pages. The text is devoted to a statement as to the reasons for selecting various portions of the route, and is signed by President Joy, Secretary Bement and Field Secretary Osterman of the organization. The report is illustrated by reproductions of maps of the Lincoln Highway and of photographs showing views of the road.

Concrete Roads in Baltimore County, Maryland*

The first concrete road constructed in Baltimore County was a short stretch at White Hall, in the year 1911. This road, 542 ft. in length and 12 ft. in width, was constructed along a stretch of road which is submerged two or three times each year, due to the swelling of a nearby stream after a very heavy rainfall. The traffic on this road is only ordinary country road travel, nevertheless the fact that no money has been spent on the concrete surface since its completion speaks well for concrete construction as a road material. There are in Baltimore County to date approximately 25 miles of concrete road, varying in width from streets 42 ft. between curbs to a 9-ft. county road.

Experience has convinced us that no concrete road should be constructed less than 14 ft. in width, while 16 ft. or, preferably, 18 ft. is far better. A road constructed 18 ft. in width greatly reduces the maintenance on shoulder work. All of our roads are one-course construction, flat subgrade, 2-in. crown and mixture of one part cement, two parts of sand and four parts of stone.

Our only maintenance on concrete roads without the bituminous skin coat, has been the treatment of cracks, which are bound to occur more or less, depending on the character of the coarse aggregate, the character of subgrade and the temperature prevailing at the time of construction.

The success of concrete roads has been judged to a considerable degree by the prevalence of cracks. This is an erroneous impression, as the cracks do not detract from the value or durability of the road if properly taken care of, except so far as they affect the surface appearance. This is shown by the phenomenal development in this type of road, the successful treatment of cracks, and the fact that many roads, although containing cracks, have given years of excellent service with a minimum cost of maintenance.

A crew of two or three men, a cart and a tar kettle are used for this maintenance work. The tools used consist of a wire bristle broom, wheelbarrow, a couple of shovels, a tar bucket and sprinkling cans. All cracks or spalled joints should be swept clean with a wire broom, after which tar heated to about 225° F. should be poured, filling the cracks or covering the spalled area. This should stand for a few moments to prevent it from bubbling, after which it is covered with clean, coarse, dry sand or clean, dry stone chips. Pit-holes are similarly treated. When an imperfection exists over an inch in depth the practice is to clean it out and dry it carefully and paint it with hot tar, after which it is filled with stone of a suitable size, graded to fill the voids as nearly as possible, and tamped in place. Hot tar is then poured over the patch, the quantity being gauged so that the tar will be taken up by the remaining voids without any large excess being left on the surface, and sand or stone chips spread with a shovel over the surface. One trip over a road yearly is usually all that is required.

ROLAND AVENUE, LOOKING SOUTH FROM LAKE AVENUE, BALTIMORE COUNTY, MD.—6-IN. CEMENT CONCRETE PAVEMENT, 1:2:4 MIXTURE.

Where a contract calls for a bituminous skin coat it has been learned by experience that this skin coat should not be applied until the concrete surface has had at least two months' travel, in order that the thin layer of latent cement which covers a new concrete road, due to the chemical action which takes place while the cement is setting, is worn off under traffic. The tar coating then applied hot thoroughly adheres to the coarse aggregate of the concrete and "stays put." Of course the concrete surface should be as clean and dry as possible before applying the skin coat of tar. Very few cracks show up on the surface of a tarred concrete road, due to the fact that as they occur they are

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*From the annual report for 1915 of William G. Sucro, Roads Engineer of Baltimore County, Md.

HOLLANDS FERRY ROAD, 13TH DISTRICT, BALTIMORE COUNTY, MD.—CEMENT CONCRETE PAVEMENT COMPLETED IN OCTOBER, 1915.

automatically filled with tar and stone dust under traffic. The tar surface on a concrete road makes a very pleasing appearance and acts as a cushion and protecting coat for the concrete surface.

The Engineer recommends the liberal use of cement concrete for road purposes in the future in order to reduce the cost maintenance on our road system, which at present is far too high in proportion to the amount of money available each year for road purposes. The cost of concrete roads in Baltimore County ranges from 79 cts. to $1.07 for plain concrete 6 ins. thick and from 89 cts. to $1.17 for concrete with a bituminous skin coat.

Battle Creek, Mich., will expend approximately $100,000 on about five miles of pavements this season.

Bell County, Ky., will vote May 18 on the question of issuing bonds to the amount of $150,000 for the construction of roads and bridges.

BELVIDERE AVENUE, 3RD DISTRICT, BALTIMORE COUNTY, MD.—CEMENT CONCRETE PAVEMENT COMPLETED IN SEPTEMBER, 1915.

The Utilization of Pulverized Earth in Asphaltic Paving Mixtures*

By FRANCIS P. SMITH†

Mr. Pillsbury's paper appears to the speaker to be especially valuable in that he discusses certain principles in connection with the paving problem from a broad and comprehensive standpoint. In considering the details of any particular process or type of pavement we are all too prone to lose our sense of general perspective, and anything which tends to bring us back to a general consideration of the problem as a whole is always very desirable.

Mr. Pillsbury calls our attention to the fact that with changes in processes of manufacture, and possibly in cementing mediums, many materials which are not now considered available for paving purposes may prove to be very valuable. This is particularly true as regards broken stone or sand in which the particles are covered or closely associated with fine material of a more or less cementitious nature, such as clay or loam. Up to very recently such materials have been regarded as being unsuitable for paving purposes, owing to the fact that during their passage through the drier the finely divided cementitious particles have a tendency to form loosely coherent balls or attach themselves more or less firmly to the larger particles. When the hot mineral aggregate is mixed with bituminous cementing material the attrition of the mass in the ordinary type of mixer is not sufficient to remove the coating which has been formed upon the larger grains or to break up the balls of fine material. The bitumen, therefore, does not come in sufficiently intimate contact with the true surface of the larger particles to form a permanently adherent coating and only the outside surfaces of the fine mineral aggregate which has formed into balls receives a bituminous coating. Under the stress of traffic and climatic changes these balls are broken up and the interior of them, composed of loose pulverized material, is removed by the action of traffic, leaving pits in the surface in which water will accumulate. The coating of fine material, which to a certain extent has been formed on the surface of the larger particles, also becomes detached, carrying with it the coating of bitumen, thus loosening the bond of these particles and permitting them to ravel out.

It has been known for a long time that clay, owing to its affinity for bitumen, is a very valuable filler or constituent for pavements of the sheet asphalt type. It has heretofore been impossible to employ a sand containing appreciable quantities of clay for the reasons above stated and the use of ground clay as a filler to be added to the mixture in place of Portland cement or limestone dust has been impracticable owing to the tendency of the clay, even after being dried and ground, to absorb moisture and form into balls.

Recent developments in machinery for the manufacture of bituminous pavements have, however, rendered it possible to use materials containing a large percentage of clay. This is accomplished by subjecting the dried and heated aggregate to the action of a pulverizer in which the attrition of the particles is sufficient to break up any balls which may have been formed by the passage of the mineral aggregate through the drier and also to thoroughly clean the larger particles from any adhering clay or powder. By the action of the pulverizer the amount of 200-mesh material can be increased up to almost any desired point. The pulverizing action naturally exerts its greatest force upon the softer particles of the aggregate and the fine material formed is therefore largely derived from the softer ingredients and thus produces a more desirable dust or filler than can be obtained from pure quartz. Heretofore one of the serious problems connected with the paving industry, more especially where the traffic to which the pavement was to be subjected was extremely heavy, was the selection of sands which, when combined, would have the different sized particles present in the proper amounts to form a dense and compact pavement. In many cases it has been extremely difficult to secure such sands, more especially those which contain the requisite amounts of 100-mesh and 80-mesh particles. With the pulverizer, practically any amount of these fine particles can be produced from a sand which is naturally deficient in them. Where sands are naturally deficient in coarse particles of the 10-, 20- and 30-mesh sizes they tend to make a pavement which is lacking in stability and is susceptible to displacement under traffic.

To a very large extent this instability of the mineral aggregate can be compensated for by an increase in the amounts of the finer particles. This is illustrated extremely well in French rock asphalt pavements, which contain practically no coarse particles and are largely composed of 200-, 100- and 80-mesh particles. The action of the pulverizer, therefore, appears to eliminate a number of the difficulties attendant upon the use of former types of machinery for the manufacture of bituminous pavements.

This does not mean, however, that the action of the pulverizer should be permitted without proper supervision and regulation. A standard sheet asphalt pavement for heavy traffic usually contains a total of from 30 to 40 per cent. of material passing the 200-, 100- and 80-mesh sieves. An increase of this fine material beyond a certain point results in increased instability of the pavement. After the critical point has been reached stability again increases. The amount of bitumen to be added to the mixture also depends upon the percentage of fine particles. As these are increased the surface area to be coated with bitumen increases and naturally calls for an increase in bitumen. Where the fine particles form the bulk of the mineral aggregate, it is often desirable to reduce the indicated bitumen contents caused by the increased surface area by thinning the consistency of the bitumen and making the coating on each grain thinner than in the normal sheet asphalt mixture. This can safely be done where the particles of the mineral aggregate (as in the case of French rock pavements) pack together very firmly when dry, and when so packed are extremely stable. Another difficulty is also met with in this connection and that is the tendency of a hot aggregate, containing a large percentage of fine material, to segregate in the storage bins, thus making it difficult to draw from them a mineral aggregate of uniform mesh composition. This, however, is a mechanical difficulty which is not very hard to provide for. Mixtures containing large percentages of fine particles also require more thorough mixing than do those in which the proportion of fine particles is lower. This would indicate increased speed for the mixing shafts and probably a longer period of mixing, but this again is dependent upon the fluidity of the bitumen used.

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*Discussion of the paper "The Adaptability of Road Paving Materials to Different Conditions and Localities," presented by F. C. Pillsbury, Division Engineer, Massachusetts Highway Commission, at the thirteenth annual convention of the American Road Builders' Association at Pittsburgh, Pa., February 28-March 3, 1916. This discussion by Mr. Smith was followed by a general discussion, a verbatim report of which follows here. Mr. Pillsbury's paper was printed in "Good Roads" of March 4.

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In asphalt block manufacture the bitumen used must necessarily be very non-susceptible to changes in temperature and is therefore relatively low in cementing value and fluidity. This makes it more difficult to thoroughly coat the particles with a firmly adherent film of bitumen and it has heretofore been absolutely necessary to use only clean, fresh broken stone in which the larger particles are free from adhering stone dust. It is probable that if a successful device can be installed which will clean the particles after their passage through the drying drums, stone which has not been freshly crushed may be successfully employed.

Mr. Pillsbury has also called our attention to the importance of drainage in the sub-foundation and the fact that foundations which are sufficient under favorable climatic conditions where frost action is largely absent are totally inadequate under other conditions where frost penetrates the soil to a considerable depth during the winter months. This is a very important consideration, indeed, as the success of certain pavements under favorable climatic conditions or on very favorable subsoils has, in a number of instances, led engineers to adopt similar types of pavements where the climatic conditions were much more severe or the type of subsoil entirely different.

As Mr. Pillsbury justly states, experience covering widely different climatic and subsoil conditions is essential before any final judgment of the value of particular types of bituminous construction can be made, and that what is one man's meat in one locality may well prove to be another man's poison in other localities.

Discussion

PRESIDENT STEVENS: Is there any discussion on Mr. Smith's remarks?

E. B. ULRICH (City Engineer, Reading, Pa.): We, in our town in the past two years, have resurfaced some old brick pavements using the Topeka mix. It was quite successful with a minimum thickness of 1½ ins. and a maximum of 3 ins., paying especial attention to compression. I listened very intently to Mr. Smith's criticism, or rather remarks, on the paper by Mr. Pillsbury, and the cleansing by attrition of the larger particles from any adhering loam or clay appeals very strongly to me with reference to sands used in asphalt paving work. We could use that very nicely in our town, and I would like to ask Mr. Smith whether it has been tried, how it has worked out, what is the method pursued and has it a name? It is a new one and I am always glad to know of something that is new.

MR. SMITH: Mr. Ulrich and Gentlemen: The method has been tried out. The application of it is something like this: Soil containing large percentages of clay has been used successfully for the construction of the type of pavement under discussion. The first pavements, as far as my knowledge is concerned, of this type were laid in Iola, Kansas, with Kansas gumbo soil as a base. That soil contains a very large percentage of clay. The process was first exploited, as far as I know, by a concern whose name, I believe, at the present time is the Bituminized Road Co. The method was substantially to first heat the mineral aggregate, then subject it to a pulverizing action, then convey it to an overhead bin somewhat similar in type to that in the ordinary sheet asphalt plant. Provision is made in that bin to prevent the segregation of the fine material from the coarse and the mixing is done in a closed mixer.

Those pavements, especially where they are composed largely of clay, are plastic in their nature, resembling sheet lead more than even the best type of heavy traffic sheet asphalt pavements do. These have been very successful under what I should consider unfavorable conditions, that is, laid directly on the soil to a thickness of approximately 3 ins. without any foundation whatever. They were subjected to what might be termed a medium residence district traffic, although at one time shortly after they were laid I believe that a very considerable amount of construction work went on in that particular neighborhood, so that for a considerable period of time they were subjected to what might be termed a reasonably heavy traffic, in addition to the ordinary delivery wagon traffic of a residence district. Recently—within the past year—similar pavements, using sand or earth containing a much smaller percentage of clay than that which was found in the Kansas soil, have been laid in Scranton, Penn. Those pavements have been down for something less than a year—some of them may have been in just about a year up to the present. These have given very satisfactory results indeed.

My idea in discussing Mr. Pillsbury's paper was more particularly to call attention to a departure from the standard methods of asphalt construction which permitted the use of materials which were available almost everywhere and which could not be used under the present well established methods of manufacturing sheet asphalt and bituminous pavements. I regard it as a very important departure and one which in all probability will lead to very important and gratifying results. There are many sections of this country where sand is available in large quantities, but except at a very high cost fine or coarse sand, depending upon circumstances, cannot be found in sufficient quantities and of the right quality to mix with the local sand and give it the proper mesh composition for the bituminous pavement to be laid.

PRESIDENT STEVENS: How about acidity and alkalinity of the soil?

MR. SMITH: The acidity and alkalinity of the soil I should say would have very little to do with it. Any normal acidity would be chiefly organic and would be destroyed by the passage of the soil through the heater, and the alkalinity of the soil—well, if it were an alkali sand such as we find in the far West I should not like to use it without first trying it out. But a reasonably small amount of alkali I should not regard as a serious matter.

MR. ULRICH: The sand question is a very annoying one with us.

MR. SMITH: I am quite familiar with your sands, Mr. Ulrich, and I know the extreme difficulty of getting a good grading from them, and that the larger particles in them are dusted over with a clay deposit.

PRESIDENT STEVENS: Any other question?

EZRA STOLTZFUS (Gap, Pa.): I would like to ask a question. Down in our neighborhood a number of years ago there was a good roads advocate who predicted that before we attain the highest standard of road making we will come to a waterproof earth road. I would like to know if any thought has been directed or anything done along that line or any step taken in that direction?

MR. SMITH: Of course, any bituminous treatment on the surface of the road may be regarded as waterproofing the surface of the road. The destroying action of water upon all bituminous compounds is very marked and the inspection must be so close as to make sure that no potholes or depressions are left which will accumulate water. However, the mere waterproofing of the surface alone will not supply other qualities which are equally essential to the formation of a good road, namely, stability, sufficient foundation and sufficient resistance to displacement by traffic and to attrition.

MR. STOLTZFUS: As I understand it, the foundation for the road you have mentioned is nothing but earth.

MR. SMITH: The foundation of the Iola road is nothing but earth, but that gumbo earth when kept away from water is very stable indeed. When water comes in contact with it, it becomes a hopeless mess.

MR. STOLTZFUS: Then can't we concede that the dry earth makes a better foundation above the water than if we used stone?

MR. SMITH: If the earth can be kept dry and in place that may be so in a number of cases, but that is extremely difficult.

D. A. GRANT (Pittsburgh, Pa.): I would like to ask Mr. Smith whether he aims to get the aggregate coarser than 200-mesh of the same grading as in standard sheet asphalt, that is, say up to the 10-mesh. Are you trying to get the intermediate aggregate between 200- and 10-mesh to conform to what is known now as standard grading?

MR. SMITH: That depends a great deal on the character of the mineral aggregate from which the road is to be made. If you adhere to the standard grading for sheet asphalt for the mineral aggregate on the 200-, 100- and 80-mesh screens you will have provided for only approximately 30 to 40 per cent. of fine material. If you carry the proportion of fine material further than that you naturally reduce the amount of coarse material, and up to a certain point, as I mentioned in my discussion, you increase stability. Beyond that point, a further addition of fine material tends to reduce stability until a certain limit is reached, beyond which stability is again increased, as, for instance, with the French rock pavements, which are largely composed of 200-, 100- and 80-mesh particles with nothing coarser than that, you have probably one of the most stable pavements that we know of and one which resists displacement to traffic better than any other known bituminous pavement. The two critical points mentioned vary with the materials used. It therefore depends upon what soil you are working with, or what mineral aggregate you are working with, whether you are going to aim to duplicate the present standard grading for sheet asphalt heavy traffic pavement or whether you are going away beyond that type and approach the French rock type.

Concrete Foundations for Asphalt Pavements and Roads Subject to Heavy Travel*

By CLIFFORD RICHARDSON†

In road construction of a permanent character, the first essential is a dry, firm subsoil. Having secured this, another and more essential factor is a suitable foundation, especially for an asphalt pavement of the highest type, or any road for carrying heavy traffic. This is emphasized by the weights the main roads have to carry because of the increase in capacity of motor vehicles to the point where their regulation is considered. Therefore, as travel increases, Portland cement will find an extended use to afford adequate support, the only satisfactory substitute for this having been found to be an old, well-compacted broken stone road. In this country, at least, this is seldom available, although good examples are found in England.

Asphalt surfaces, in themselves, have no strength to support heavy loads and, like other surfaces, require adequate support when subjected to concentrated travel. Any type of surface that is selected to carry heavy traffic must have a proper foundation and such a foundation can be provided in no more satisfactory way than by the laying of a Portland cement concrete foundation. While, for some years, this has been recognized in certain instances, it must have general acceptance in the near future, at least in reference to main roads. And it is generally desirable, as a matter of permanence, where funds are available. The primary difficulty is, of course, that of funds, but as a concrete foundation needs no maintenance its cost may properly be met by the issue of long-term bonds.

The thickness of concrete required depends, of course, upon the travel to be carried and the support to be received from the subsoil. On one of the most heavily traveled streets in London, England, it has been proposed to lay 11 ins. The usual thickness in this country has been 6 ins. for our most important thoroughfares, but this will have to be increased in the near future because of the disturbance for underground operations and the increasing weight of motor trucks.

It is coming to be recognized, at least by experts, that concrete aggregates, especially sand, must be more carefully selected. In work of the highest character, testing the sand is as important as testing the cement. It has been shown that one brand of cement will give better results with one sand than with another, although each kind of cement may give the same result with standard sand. It is evident, therefore, that there is great opportunity for improving the character of concrete, and it is encouraging to know that extensive investigations are being made in this direction.

A cement concrete foundation may be looked upon as a permanent investment. To a certain extent, concrete road surfaces may be regarded in the same way, for when they become too rough to be used as surfaces they can be utilized as foundations for other types of surfacings.

California is expending millions of dollars in the use of cement concrete for highways, and the expenditure is looked upon as one that will be an asset for many years. Upon the concrete is laid an asphaltic surfacing with an aggregate composed of sand and fine pea-grit. This is put on to provide a surface more agreeable to travel, and costs but 8 cts. per sq. yd. It is a temporary surfacing for use where the traffic is light and little money is available, but is expected to last for three or four years and to give an adequate return for the money expended. Where travel is more concentrated an asphaltic surfacing containing fine stone is used. This may be looked upon as more durable and costs 50 cts. per sq. yd. Looked at from an economic point of view there is probably no other state in which so satisfactory a combination of cement concrete and bitumen has been used, although the concrete may be regarded as too thin, as it has a thickness of only 4½ ins. This, of course, is partly due to the favorable climatic conditions.

It is worthy of note that where cement concrete is protected by a bituminous or other surface, a leaner concrete can be used than it is well to employ where the concrete is exposed to travel, and, therefore, the concrete is much less expensive.

Experience has shown the possibility of greatly improving the present methods of mixing and placing concrete in road work. Too much such work is done carelessly, without proper study of the mineral aggregate and without giving enough time for thorough mixing. But engineers are awakening to their shortcomings in this respect and there will doubtless be a great improvement in the near future.

Although it is recognized that American cement is generally of a very high quality, the characteristics of the cement used for foundations and the fineness of the grinding are factors of great importance in the success attending its use.

Climatic conditions and the great extremes of temperature result in the formation of cracks in monolithic cement concrete road foundations, and these cracks are often reproduced in the surfaces themselves. The effects of such cracks, however, usually disappear within a few years, and are not afterwards manifested to any disagreeable extent. That such cracks are due principally to contraction caused by extreme temperatures is demonstrated by the fact that they are less apparent in a climate like that of California where there are no extremes in temperature. In certain instances, expansion at joints between the work done on two days has been observed, but this seldom happens and is not manifested after the expiration of a few years.

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*Abstract of a paper presented at the Twelfth Annual Convention of the American Concrete Institute, Chicago, Ill., Feb. 14-17, 1916.

†Consulting Engineer, New York, N. Y.

The Preparation and Use of Asphalt, Cut Back with Naphtha, for Road Surface Treatment[*]

By JULIUS ADLER[†]

The object of this paper is to outline briefly the preparation and use of asphalt, cut back with naphtha and applied as a paint coat in macadam road surface treatment, in the practice of the Bureau of Highways and Street Cleaning, of Philadelphia, during the past four years.

Beginning with the recognition of the fact that many of the grades of asphaltic surface treatment materials in use possibly five years ago were faulty in their tendency to "push" or displace, particularly when applied as comparatively thick pads in surface treatment work, and further with the idea of developing an asphaltic material which, while liquid at the time of application, would develop setting or hardening qualities somewhat similar to those exhibited by some of the tar products, an experiment was carried on on Riverdale Avenue, in the Borough of The Bronx, in the fall of 1911, using a cut-back compounded of 65 per cent. by weight of 140 penetration asphalt and 35 per cent. by weight of naphtha, in comparison with stretches of crude liquid asphalt and other asphaltic products. This section of roadway was covered by a heavy snow on the following day, with disastrous results to practically all but the asphalt cut-back section. The work begun at this time has been continued in the City of Philadelphia, as will be described in more detail later.

In order to explain better what are considered the desirable properties of this preparation contrasted with other asphaltic surface treatment materials, some of the fundamental differences between the various grades of these products will be considered. Beginning with the light road oils used for cold application, frequently spoken of as "45-per cent. oils," etc., indicating by the use of this figure that the oil is supposed to contain about 45 per cent. of asphaltic base of 100 penteration, as determined by the so-called asphaltic content test; the liquid or crude asphalts consisting of unrefined asphaltic petroleums; and finally the heaviest grade of products of this character, often called "hot oils," containing from 65 to 90 per cent. of asphaltic base of 100 penetration, determined by the above mentioned test, it is found that all three of these products contain varying but in all cases considerable percentages of oils which in their after effect upon the completed surface treatment work, may properly be called lubricating oils. In the case of the light or cold road oil, this material, whether compounded as a mixture of a flux and a base, or whether simply prepared as a straight distillation product, will in the final analysis contain only 45 to 50 per cent. by weight of a base somewhat softer than 100 penetration, while the remaining 55 to 50 per cent. of material consists of non-drying oils. Proceeding in the direction of a heavier material of greater binding base and, consequently, of more permanence, the hot oils have been developed, some of which contain only a comparatively small percentage of fluxing ingredients. Instead of using light oils as a flux or carrying agent to reduce the viscosity of this grade of material the hot oils contain only enough of lighter ingredients to make it possible to thin them out readily by the application of heat, thus reducing their viscosity (at least at the moment of application) and supposedly giving them an equal penetration into the road surface. The best of this latter grade of materials, however, still contain enough fluxing components so that they will always show a tendency to soften more than is desirable in hot weather and, consequently, tend to push upon the road surface. The third grade of materials named, that is, the crude liquid asphalts, naturally contain the intermediate fluxing and lubricating oils described in the case of the two preceding materials together with a varying percentage of volatile components (depending upon the origin of the oil) and, consequently, show in use an appreciable drying on the surface of the road after their application. This material, then, from the standpoint of results obtained, may be said to possess the advantage of having a comparatively low viscosity with little or no addition of heat at the time of application, and to have in addition the ability to set up or harden partially on the road surface. On the other hand, it must be recognized that all of the oils intermediate between the volatile matter and the heavy base are retained in these crude asphalts and consequently have the same lubricating effect in the future as described in the case of the other two materials.

In distinction to all three of these grades of materials asphalt, cut back with naphtha, within the meaning of this paper, possesses all of the desirable qualities of a material consisting of a heavy base mixed with volatile components only, consequently, having a desirable low viscosity at the time of application (thereby making it easy to spread in practically any quantity desired and under any temperature condition) having a high penetration into the road surface, and through its drying properties, leaving behind a heavy binding base which will exhibit little tendency toward displacement during hot weather, when combined with a suitable mineral aggregate.

The importance of a low viscosity at the time of application of any bituminous surface treatment material, as an aid to ease of application in small quantities per square yard, and to good penetration into the road surface is generally understood, but the merits of the three methods by which this low viscosity is obtained are not so well understood and will bear repetition. In the case of the light road oils, this is accomplished by the presence of a considerable quantity of light oils, of an almost non-drying character, giving the mixture a considerable ability to penetrate and hold down a layer of dust on the road surface. In the case of the heavy road oils, this low viscosity is accomplished chiefly through the application of heat, with the consequent result that this material, applied in a thin sheet to a surface always considerably cooler than itself, loses its heat rapidly, and with its heat, its low viscosity and its ability to penetrate into the road. When working in cool or cold weather this unfavorable condition is clearly intensified. In contrast with these, the low viscosity of the asphalt cut-back mixture is due entirely to the thinning action of the naphtha, which is not a permanent ingredient, as in the case of the light road oil, and which, while volatile in its nature, does not lose its thinning action almost immediately after the mixture has reached the road surface as in the case of the hot oils. As a further contrast very slight changes in the proportions of naphtha used will produce sufficient changes in the viscosity of a mixture to counteract the chilling of a cool atmosphere.

To illustrate the considerable changes which can be made in the consistency of cut-back mixtures by the addition of comparatively small percentages of naphtha, the following three partial analyses are given:

	(a)	(b)	(c)
Spec. Gravity 77° F.	0.915	0.896	0.876
Viscosity (Eng., 50 cc. at 77°F.)	800″	257″	77″
Loss, 20 g., 5 hrs., 325° F.	31.83%	36.67%	43.43%

The first represents a mixture too heavy for this purpose, the second a normal mixture (250 to 350 seconds representing the desirable figure) and the third, one which is considerably too thin. The loss at 325° F., 5 hours, is an accurate measure of the amount of naphtha in the mixture.

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[*] Paper presented at the Columbus, Ohio, meeting of the American Association for the Advancement of Science.

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With the difference between these various grades of materials in mind, the conclusion is that insofar as asphaltic products are concerned (and this paper is limited to a discussion of them only) and where a heavy pushing traffic is expected upon the road to be treated, asphalt cut back with naphtha is the most desirable of all of these products because of its freedom from intermediate oils. For other conditions of traffic than those mentioned, the other materials may give equally satisfactory results at lower costs.

The Philadelphia specifications for this material are divided into three portions, the first, defining the properties of the naphtha and requiring a volatile commercial naphtha of 53 to 60 degrees Beaume gravity; the second, defining the properties of the asphalt and calling for a residual asphalt of 85 to 100 penetration of a ductility and specific gravity (45 c.m. and 1.02 minimum values, respectively) which would bar a highly blown product; the third, defining the properties of a 65 to 35 per cent. mixture by weight of the two materials as to specific gravity, Engler viscosity (first 50 cc. at 77° F.), loss by volatilization at 325° F., and character of the distillate and residue resulting from a distillation to 300° C.

In the interpretation of the results of tests of such mixtures, the viscosity test is used fundamentally as a final determination of proper consistency; the loss at 325 degrees, 5 hours, is used to determine that the proper percentage of volatile naphtha has been used in the mixture; the specific gravity of the mixture is similarly useful as a quick check on the proportions of the ingredients (where their specific gravities are known with considerable assurance); and the two products resulting from the distillation test are intended to show, first, that a volatile naphtha of the proper gravity has been used, and, second, that the asphalt was of proper penetration and ductility. In the latter connection if the naphtha used contained a non-volatile kerosene fraction, this will be retained by the asphaltic residue from the distillation test, resulting in a considerable fluxing of the asphalt as indicated by the increased penetration of the residue and frequently by the increased ductility, while the volatile ingredient distilled off may appear to have been entirely satisfactory because of the fact that it has lost its heavy fraction. This same action may be expected on the road surface, thus defeating the purpose of securing an asphalt residue of maximum desirable hardness. With the best of light naphthas, however, there is a tendency (in the laboratory) for the residue from this distillation to show a slightly increased penetration and ductility, due probably to a small quantity of the naphtha dropping back into the asphalt as a result of cracking or other causes.

The following results of tests on typical samples of asphalt cut-back and light road oil will serve as a means of comparison between two materials of similar viscosities and penetrating ability but of quite different heavy asphalt content and setting qualities:

	Asphalt Cut-Back.	Light Road Oil.
Spec. Gravity, 77° F.	0.903	0.925
Gravity, Deg. Be.	23.9	21.3
Viscosity (Eng. 50 cc., 77° F.)	245″	275″
Loss, 20 g., 5 hrs., 325° F.	37.00%	11.15%
Penetration of residue	41	Flows
Asphalt content (100 pen., 500° F.)	(63.00%)	44.5%
Distillate to 300° C., grav. deg. Be.	57.4	....
Ductility of residue, cm.	100 plus	....

These results properly interpreted, indicate (insofar as laboratory tests can) the differences which may be expected in the actual application of these materials. The light oil, though of the same viscosity, is seen to have considerably less volatile or drying material, as indicated in a general way by the loss at 325° F., and to contain a smaller quantity of a softer base as indicated by the difference in the penetration of residue from the volatilization test and the lower asphalt content.

Recognizing the difficulty of determining positively (as suggested by the points previously noted) that proper ingredients have been used, when relying solely upon an examination of the completed mixture, this work has been carried on subject to a plant inspection of the materials and methods of proportioning the mixture. Where the general character of the ingredients in use in a given plant is fairly certain, the actual testing work done by the inspector in the plant consists only of such tests as are necessary to indicate that these same grades are still being used, and to check the proportions and final consistency of the mixture. This can be accomplished by a gravity and distillation test on the naphtha, by a specific gravity and penetration test on the asphalt, and by a specific gravity and viscosity test on the mixture. Before going into the plant, the inspector receives instructions covering the desired approximate proportions by weight and final viscosity, and in addition to making the preliminary tests noted on the two ingredients, determines also their temperature in their respective tanks, computes from the specific gravities at normal temperatures of 60° for the naphtha and 77° for the asphalt, the respective specific gravities of the two ingredients at the temperatures actually found, using coefficients of expansion of .00033/°F. for the asphalt and .00048/°F. for the naphtha. With these corrected specific gravities and the original required proportions by weight he determines the corresponding required proportions by volume and from this the required number of gallons of the two materials at the temperatures found.

The method of combining the naphtha and asphalt is, of course, optional with the plant, providing that the proper result is obtained. Mixing done in open tanks is open to criticism because of the loss of volatile naphtha. The most economical method, therefore, is to pump the naphtha and the hot melted asphalt, each of which is gauged separately, into a closed tank, placing the naphtha on the bottom to facilitate the mixing and then circulating or agitating the material until a homogeneous mixture has been secured.

Knowing the specific gravity of the ingredients, the specific gravity of the mixture may be used as a quick and very accurate means of determining that the proper proportions of the two ingredients have been placed in the mixture, and to aid in this work a table has been prepared showing the specific gravity of mixtures of various proportions by weight of all the common grades of residual asphalt with naphthas of 53 to 60 degrees gravity. The viscosity test is afterwards made as the final determination that the desired consistency of mixture has been obtained.

The use of the specific gravity test (using an hydrometer which can be read to .001 on the specific gravity scale) as an accurate index for determining quickly that given proportions of naphtha and asphalt are present in the mixture, is illustrated by the following partial results of tests on four samples, showing the decreasing naphtha content, and increasing viscosity, with very small increases in the specific gravity. All samples consisted of the same grades of naphtha and asphalt from one refinery.

	(a)	(b)	(c)	(d)
Spec. gravity, 77° F.	.906	.907	.910	.912
Loss 5 hrs., 325° F.	33.12%	32.52%	32.45%	31.27%
Viscosity, Eng., 50 cc., 77° F.	386″	391″	481″	513″

The question of the application of this material to the road surface will not be considered here because of the extent to which this whole subject has been previously discussed. To summarize the matter, however, the following desirable qualities of this material will be repeated:

Low viscosity accompanied by a binding base as heavy as can safely be used without disintegration in cold weather.

High ability to penetrate a thin film of dust and adhere to the solid road crust.

Adaptability to application in large or small quantities per square yard, as required for original or retreatment.

Adaptability to variations in temperature conditions, by making small changes in the naphtha content.

Wood Block Pavements*

By GEO. W. TILLSON†

The first thing to consider is the character of the wood itself. It is generally recognized that long leaf yellow pine is the best material. This, however, is an expensive wood and obtained only in certain sections of the country, and if other woods that are more general in their growth can be used after proper treatment and under certain conditions, the cost of the pavement will be very materially reduced. The government has been making experiments to determine this, and it is hoped that a satisfactory solution will be reached.

There is very little disagreement regarding the size of the blocks. They are generally 3 or 4 ins. in width and 3½ to 4 ins. deep, and average about 8 ins. long.

The treatment of the blocks, however, is the most important. Blocks have been treated with what is known as the zinc process, and the writer saw some in Brussels, in 1913, being laid on the Waterloo Boulevard that had been treated with sulphate of copper, but to a very slight extent. In this country, and probably in Europe as well, it is generally considered that the best preservative is creosote oil. Creosote oil is now manufactured from both coal tar and water gas tar; the former material has been used to the greatest extent and has given satisfactory results. The proponents of the use of the latter contend that it is as good as the coal tar oil. The experience with the water gas oil, however, at the present time has not been such, in the judgment of most engineers, as to make this conclusion positive. Experiments should be carried out to demonstrate the usefulness of the water gas oil, as wherever possible the greatest competition should be allowed to all materials. If the oil from the water gas tar is as good a preservative as that made from the coal gas tar, it should be known and used in open competition with the coal gas tar oil.

Whatever oil is used there is always the question of its character and the amount to be used per cubic foot of wood. As regards the character, the principal difference has been as to the specific gravity. Certain people claim that an oil of a gravity of practically 1.03 should be used, and others an oil of at least 1.08 and preferably 1.10. The advocates of the lighter oil contend that it is less expensive, and that on account of its lower specific gravity it will penetrate more freely into the pores of the wood and thus give a more uniform treatment. The advocates of the heavy oil, however, claim that with proper methods of treatment the blocks can be thoroughly impregnated with the heavy oil and that, because its specific gravity is greater, it will be retained in the block for a much longer period of time and so prolong the life of the block correspondingly.

It must be understood in this connection that the object of the treatment is not only to preserve the blocks from decay but also to increase their stability as to size, so that they will not expand in wet weather, thus causing bulging of the pavement, or shrink in dry weather, thus causing the blocks to become loose. The writer has always believed that the life of a wood pavement in most American cities will depend upon the length of time that the blocks will last without decay; in other words, that it will rot out before it will wear out, and the treatment that will for the longest time prevent the block from decaying will be correspondingly valuable.

A piece of wood pavement taken up in Brooklyn after it had been in use for eleven years, on a fairly heavy traffic street, showed a wear of only ¼ in., so that, assuming that the blocks could stand a wear of 1 in. before becoming too rough for use and that the blocks would not decay, that pavement would have a life of 44 years. It would seem to the writer that an oil of heavy gravity would preserve the block for a longer time than one that was lighter.

The same argument would seem to hold good as regards the amount of treatment to be used. In Europe the general practice is to use about 10 lbs. of oil per cu. ft. There, however, as a rule the pavements wear out before they rot out, on account of the much heavier traffic that comes upon them. In Paris and London wood is laid on the heavy traffic streets. One reason for this is because the pavement is so nearly noiseless.

The early practice in this country was to use 20 lbs. of oil per cu. ft. This practice to a number of people has seemed to be excessive, and the quantity has been reduced to 16 lbs. and sometimes to 14 lbs. per cu. ft. If 16 lbs. is sufficient, it is a waste of money to use 20 lbs., but if 20 lbs. will prolong the life of the pavement more than sufficiently to pay for the extra cost of the 4 lbs. per cu. ft., it should be used. It will undoubtedly take some time to demonstrate what is the proper amount under different conditions. It can be said, however, as a general principle, that the heavy traffic streets will not require as much treatment per cu. ft. as the light traffic streets.

It is also argued against the larger amount of oil that the pavements are more liable to "bleed," that is, to cause the treatment to exude upon the surface of the street, than if the smaller quantity is used.

Joint Filling.—There is also considerable variation in the use of joint filling, the materials being cement grout, pitch and sand. The same arguments can be used as regards the filling as with the stone blocks generally, except that sand is not considered permissible under any conditions in stone or brick pavements. The idea is to protect, by the filler, the edges of the stone or brick from undue wear. As the edges of the wood blocks are smaller than in either stone or brick, and as the wood is tougher than the stone or brick, this point is not so important.

One argument against the use of pitch is that when the blocks expand the pitch is apt to be crowded out upon the surface of the street, thus adding to the nuisance of the bleeding, but, on the other hand, it is urged that when pitch is in each joint, each joint becomes an expansion joint and so lessens the liability of the bulging of the pavement. Where there is a reasonable amount of traffic the writer believes that the best results will be obtained by the use of fine, dry sand.

Cushion.—Two kinds of cushion have been in use in wood pavement, one a mortar bed consisting of one part of cement to three or four parts of sand, and the other of sand. The objection to the mortar bed for wood blocks is less than for stone or brick, because the wood itself is a resilient material, so even if the bed is solid it does not present a solid construction. The writer believes that a smoother surface can be maintained with a mortar bed than with the sand cushion. In Europe the blocks are laid directly upon the concrete foundation. This, however, necessitates the concrete having so smooth a surface that the blocks will bear evenly upon it. As gravel is used in Europe almost entirely for the concrete foundation for pavements, this result is more easily obtainable than it would be with the broken stone in this country. It would entail considerable expense to have the concrete foundation struck to the smooth surface that would be necessary if no cushion were used, and it would seem that almost the same results can be obtained by the mortar bed. Sometimes, however, in Europe a coat of bitumen is spread over the concrete before the blocks are laid. This, however, is for the purpose of keeping moisture out of the bottom of the blocks rather than to serve as a cushion for the blocks themselves, as it is not sufficiently thick to serve as a cushion.

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*Extract from a paper entitled "City Pavements," presented at the recent road congress at Worcester, Mass.

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"Good Roads Day" in Pennsylvania

(Contributed)

The State of Pennsylvania has been one of the leaders in the East in a movement which originated in the middle western states several years ago for the betterment of the highways.

The credit for originating the "good roads day" idea in the commonwealth belongs to Washington County. Dr. W. D. Martin, a practicing physician of Morris Township, in the southern part of the county, is the father of "good roads day" in Pennsylvania. Early in the spring of 1914 Dr. Martin conceived the idea of having such a day in his township. The results were so gratifying that Dr. Martin thought the movement could be carried out successfully throughout the county. He outlined his idea to several leading business men in the county and a meeting was called, at which plans were discussed for having a "good roads day" in Washington County. May 26, 1914, was the day set for the first observance of this day in any county in the state. The movement was so successful in Washington County that year that Dr. Martin thought it could be continued as a state-wide measure. Accordingly, the "good roads day" organization in that county named a committee which drafted a resolution and presented it to the Governor, requesting that May 26, 1915, be designated as "state-wide good roads day" in Pennsylvania. Governor Martin G. Brumbaugh therefore issued a proclamation, fixing that day and calling upon all citizens to give their time to the improvement of the highways in their respective localities. The proclamation met with instant response. Although the day was a dismal one, with heavy rainfall in many counties of the state, more than 78,000 citizens turned out and spent the day in hard physical labor on the roads.

Thus Dr. Martin in two years has seen his township idea grow into a successful state-wide movement.

This year Governor Brumbaugh, on March 30, issued a proclamation fixing Thursday, May 25, as "State-wide Good Roads Day" for 1916.

The Pennsylvania State Highway Department, while in no sense fathering the "good roads day" idea, nevertheless, lent to the movement last year its heartiest cooperation and the State Highway Commissioner has expressed his intention this year of rendering a like assistance.

In more than two-thirds of the counties in the state associations have been formed either last year or this year for the purpose of aiding the annual observance of this day. These associations are composed of all interested in the subject of good roads and it is a significant fact that in the rural communities the greater proportion of the membership in these good roads associations consists of farmers who are most enthusiastic in their support of a plan which will help to realize their cherished ideal of improved highways.

Conservative estimates compiled in the State Highway Department on returns made from every township in the state last year place the value of the work accomplished throughout the commonwealth at between $200,000 and $300,000.

VOLUNTEER WORKERS IN CAERNARVON TOWNSHIP, BERKS COUNTY, PA., ON "GOOD ROADS DAY" IN 1915—SPREADING CRUSHED STONE

It is considered entirely probable that not only will the number of persons at work on the highways this year far exceed the number similarly employed last year, but also that the value of the improvement, whether temporary or semi-permanent, will be greater than the estimated value of last year.

An outstanding feature of 1915 "state-wide good roads day" was that many large corporations in the more thickly populated centers voluntarily closed their plants on that day to permit their employees to contribute their time and labor to the cause of good roads. Although business conditions in Pennsylvania are much more active this year than they were in 1915, it is anticipated that this attitude on the part of employers of labor will be continued this year. With fair weather it is expected that more than 200,000 men will turn out.

WHITEWASHING TELEGRAPH POLES AND HEAD-WALLS ON THE CUMBERLAND ROAD BETWEEN WASHINGTON AND CLAYSVILLE, PA.—1915 "GOOD ROADS DAY."

The work done on the highways on "state-wide good roads day" is not confined to the main traveled thoroughfares, but in each township in the state the supervisors, assisted by the volunteer efforts of their neighbors, turn in and place the township roads in passable condition. Road dragging, road scraping and rolling are among the first of the activities demonstrated on the earth roads. Ditches and gutters are opened, brambles are cleared away, head-walls are whitewashed and generally the appearance of the road is much improved. Wherever a particularly bad stretch of road exists in any township, it is to this the concentrated efforts of the volunteer workers are given that better results may be obtained.

Construction and Cost Data on a Bitulithic Pavement in Pierce County, Washington

A bitulithic pavement has recently been completed on the road connecting Alderton and Orting in Pierce County, Washington. The data on the construction methods employed on the road and on the cost of the work contained in the following paragraphs were supplied by County Engineer David H. White of Pierce County.

The road is 5.319 miles long and is paved to a width of 16 ft., the pavement consisting of a 2-in. bitulithic wearing surface on a 5-in. 1:3:6 concrete foundation with 6-in. concrete curbs, and 3-ft. bank-run gravel shoulders. The pavement was laid on an old gravel road constructed on alluvial soil, and in the new work the original grade was followed as closely as possible in order to obtain the benefit of the well compacted gravel as a subgrade.

GOVERNOR MARTIN G. BRUMBAUGH OF PENNSYLVANIA HANDLING A SHOVEL IN CUMBERLAND COUNTY—1915 "GOOD ROADS DAY."

Sand for the bitulithic top and both sand and gravel for the concrete base were obtained from a pit owned by the contractors, situated a little over a half mile from McMillan, where the bitulithic plant was installed. The average haul for the concrete aggregate was 1.95 miles, and the average haul for the bitulithic mixture was 1.35 miles. Crushed granite was furnished to the contractor at cost from a county-owned quarry, the contractor paying freight at the rate of 1 ct. per ton per mile from the quarry to McMillan, a distance of 13 miles. Concrete cost the contractor $2.30 per bbl. delivered at the work with a rebate of 40 cts. per bbl. for sacks.

The bitulithic plant was of the one-car type, the sand bin being divided into four compartments. The crushed rock and sand were piled separately near the end of the rotary drum of the heater, a 2-horse scraper being used to bring the rock and sand to the elevators. After being heated to from 240° to 250° F., the aggregate was passed over screens and separated into four sizes as follows:

No. 1, Aggregate passing No. 10-mesh screen.

No. 2, Aggregate passing ¼-in. screen and retained on No. 10-mesh screen.

No. 3, Aggregate passing ½-in. screen and retained on ¼-in. screen.

No. 4, Aggregate passing 1¼-in. square opening and retained on a ½-in. screen.

Each of these four sizes was delivered in one of the four bins referred to. In general, the proportions of the materials used in the mixture were as follows: 315 lbs. from No. 1 bin, 90 lbs. from No. 2 bin, 140 lbs. from No. 3 bin, 440 lbs. from No. 4 bin, and 15 lbs. of fine dust, making a total of 1,000 lbs. of aggregate. To this was added about 88 lbs. of bitulithic cement heated to a temperature of 250° F. These materials were thoroughly mixed in a twin pug mill for about 1 min. and 40 sec. and then dumped into wagons and hauled to the work.

The material arriving at the work was unloaded, spread on the foundation and raked to as nearly as posible the proper depth. It was then rolled with a 10-ton roller, more material being added if low spots appeared. After the completion of the rolling, bitulithic cement to the amount of about ¼ gal. per sq. yd. was applied by means of a squeegee car and the surface then covered with hot screenings from No. 1 bin, with a small amount of sand. The bitulithic cement was heated in kettles at the street and the screenings and sand were applied by a sand spreading machine at the rate of about 25 lbs. per sq. yd. The pavement was then given a final rolling with the 10-ton roller.

The force used at the plant and the wages paid were as follows:

1 superintendent furnished by the patentees..	$200.00	per	mo.
4 feeders, 3 using shovels and 1 a hoe, to feed the aggregate into the elevators..........	2.50	"	day
1 foreman	100.00	"	mo.
1 drum fireman	2.50	"	day
1 boilerman	2.50	"	"
1 hopper man	2.50	"	"
1 mixer man	2.50	"	"
1 team	5.00	"	"
1 night watchman	3.00	"	"

From three to thirteen teams at $5 per day were used to haul the material to the pavement. The force employed on the pavement and the daily wages paid were as follows:

1 foreman	$4.00
1 rollerman	3.50
1 man cleaning pavement	2.25
1 wagon dumper	2.50
1 tamper	2.50
5 shovelers	2.50
2 rakers	2.50
2 squeegee men	2.50

The work was commenced on the bitulithic wearing surface on Oct. 21, 1915, and ended Feb. 28, 1916. The whole number of days on which work was done was 48, bad weather and other conditions causing considerable delay.

History of Highway Development in Massachusetts

By Wm. E. McClintock[†]

From its earliest permanent settlement Massachusetts was an English colony, in language, laws, customs and methods of doing things. A history of the rural highway of Massachusetts would much resemble a history of the rural highways of England in the days before McAdam and Telford. There was little inclination to do more than improve the older settlements, develop unsettled areas and build canals and railroads, and the large amount of money required for these left no funds for the improvement of rural roads and comparatively little money for the improvement of city streets.

The invention of the stone crusher and the steam road roller would have aided in the improvement of rural highways, but small communities could not afford to purchase these machines. Occasionally a city or town would purchase a stone crusher, but broken stone was not used so much for building roads as for building up especially bad holes, and no attempt was made to secure economy in the breaking of the stone. Inasmuch as the roads were of earth, the usual requirements for a road master were a knowledge of tilling the soil and ability to drive a team. Until 1871 the highway tax was worked out, and no lasting good roads came of this method.

The advent of the bicycle, which brought people into the country, brought about a change. The really bad condition of all roads and of the rural highways in particular was soon discovered, and in the early eighties the number of wheelmen had become sufficiently great to create a demand for better city streets. Then came study showing the tremendous economic waste resulting from bad roads. Through the wheelmen's efforts, the efficiency of the road masters was increased, and road building was finally taken up as a part of the civil engineer's work. During the eighties several cities installed crushing plants and purchased steam rollers, and later, after the discovery of the necessity of separating the broken stone into sizes and saving the dust for binder, many cities began to build modern broken stone roads. In 1891 a large stone cruching plant was established at Salem, Mass., by A. J. Wellington. The labor saving devices of this plant made it possible to deliver broken stone at a reasonable cost in all parts of the commonwealth served by the Boston & Albany Railroad. Within a few years similar plants were established at Waltham, Deerfield, Hingham, Westfield and Bridgeport. In 1891 the town of Spencer established the first modern town plant, consisting of a rotary crusher, elevator and bins, and other towns and cities soon followed.

The attention of road builders was first called to the necessity of using trap or other tough rock at a meeting of the Boston Society of Civil Engineers, when the writer read a paper on the geology of road building. This subject was taken up later by the State of Massachusetts and still later by the Office of Public Roads at Washington.

At this time, the L. A. W., with a large membership and ample facilities, had been advocating the cause of better roads for several years. They had published a good roads magazine and done other work looking to the extension of road improvement. As a result a few towns in Massachusetts had laid broken stone on one or two of their village streets and sometimes had extended the improvement for some distance on an important road. There is no evidence, however, of an awakening public spirit which would compel the authorities to improve the main arteries. The necessity of doing something seemed to be universally recognized but nobody knew how to organize the different communities for united action or how to finance the undertaking if such a combination could be effected.

In 1892 the L. A. W., led by George A. Perkins and Col. Albert A. Pope, secured, after an unusually aggressive campaign, the passage of an act to establish a commission to improve the highways. Mr. Perkins, Professor N. S. Shaler and the writer were appointed to this board, which organized on July 5 and elected Mr. Perkins chairman.

The commission was charged with the investigation of conditions throughout the state and with reporting back to the Legislature recommendations as to the treatment of the problem. The commission secured information by reports from local officials, public hearings and personal investigations. Assuming that the work included a campaign of education among the road masters as well as obtaining information, various methods of construction were studied, collated and printed for general distribution. The members of the commission made addresses at county hearings and in general conducted a campaign of education. Upon the completion of the investigation the commission submitted a report to the Legislature in which every phase of the problem was discussed, the commission having in mind not only the members of the Legislature to whom the report was directed but also hoping to place a textbook at the disposal of the road masters of the state. From the information secured, it was deduced that the chief obstacle in the way of improving the rural highways was lack of money, as 253 out of a total of 320 towns made an annual expenditure of less than $100 per mile, while in 232 of the 253 towns the expenditure was less than $40 per mile per year.

The only statement made in the report which could be interpreted as favoring a state commission was in the following paragraph:

"The natural conclusion of the above statements is that certain cases arise in the management of public ways which cannot be overcome under the present system of county commission supervision, and that the arbitrarily defined county lines are an obstacle in the way of a perfected general scheme."

Little opposition developed at the hearings on the bill by the Legislative Committee on Roads and Bridges, while the L. A. W. strongly favored its passage. As a result, an act to provide for the appointment of a highway commission was passed in June, 1893. Governor Russell appointed Messrs. Perkins, Shaler and McClintock to the commission, and Mr. Perkins was again elected chairman and Austin B. Fletcher was made secretary.

Previous to this, as a result of a meeting in the office of the commission between the writer, Charles W. Ross and Richard A. Jones, the road masters of many cities and towns came together in March, 1893, and organized the Massachusetts Highway Association, of which the writer was elected the first president.

Another indication of the momentum acquired by the good roads movement was the introduction of a half-year course in the Lawrence Scientific School of Harvard University. The writer also had the honor of being chosen as instructor in that course.

The act establishing the highway commission authorized it to investigate and compile road statistics; collect, collate and designate on maps geological information relative to road material; prepare a road map of the state; report upon its findings to the Legislature, making suggestions and recom-

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[*] Abstract of a paper presented at the Worcester, Mass., Road Congress.

[†] Former Chairman of the Massachusetts Highway Commission.

mendations as to the policy of the commonwealth; advise with municipal officers on the construction and maintenance of roads, and to hold hearings at least once a year in each county for the open discussion of road matters. Later the Highway Commission was authorized to take over and build main highways petitioned for by county commissioners under certain conditions, the roads so built to be state roads and to be maintained as such by the commission at the cost of the state. The county commissioners, resenting what they felt to be an infringement upon their rights, uncertain of public opinion and with no sure knowledge of what the cost to the counties would be, presented few petitions, and no state roads resulted from the establishment of the act. The advice of the commission, however, was in great demand, and the commissioners responded to many calls from all parts of the state. Many personal inspection trips were made, and these investigations showed that outside of the centers of population there were no good roads except in isolated places where short stretches passed over a natural road gravel. On one trip the commission left East Sandwich at 3 o'clock in the afternoon and reached Provincetown, 50 miles away, at 7:30 the next afternoon, after riding 7 miles by rail and using up 5 pair of horses. The roads were very sandy and had many steep grades. For similar reasons, 3 hours were required to ride over 9 miles between Orleans and Chatham, and 5 hours to traverse the 24 miles between Chatham and Hyannis. Conditions were similar over all of Cape Cod and a large part of Bristol and Plymouth Counties. On the shore road between Plymouth and Sagamore, which was too narrow for teams to pass except at specially provided turnouts, the ruts were 10 to 14 ins. deep and it was a half day's trip to ride over the 14 miles of its length. Four hours were used to ride 7 miles between Wareham and New Bedford in the spring when the frost was coming out of the ground. On most of the main rural highways excessive grades, sandy surfaces or clayey soil prevailed, either separately or collectively, causing a waste of time and money to the traveler and those obliged to transport freight over the roads.

Being made familiar with these facts and other evidence and arguments, the act of 1893 was amended in the following year in two important details—first, with reference to petitions, and, second, in reference to the powers of the commission. By the amended act the selectmen of any town, or the mayor and aldermen of a city, as well as the county commissioners, were authorized to petition the State Highway Commission for the taking over of a road as a state highway. In addition, in place of separate bills for the construction of each road to be submitted to the Legislature, the sum of $300,000 was voted for use by the Highway Commission in the construction of state highways without further legislative action.

After personal inspection tours, conferences with local officials and others, certain main highways were selected by the commission as worthy of becoming state aid roads. These were in all parts of the state, and the commission adopted the policy of making comparatively short layouts on these highways in as many different municipalities as possible so that the local road masters might obtain experience by building modern roads under expert advice and also so that the roads themselves might serve as object lessons. The work of the commission was in an untried field. There were no available road builders and men had to be educated. An engineering force was organized to make the necessary surveys and inspect the roads built, and as none of the men in the first organization had acquired experience in such work they had to be educated. This was a strenuous task, but the men did learn and in a few years Massachusetts had the best body of trained engineers in the country. They were, in fact, too well trained, because other states repeatedly tempted the men away from Massachusetts. The type of road built was that which best fitted the soil conditions throughout its entire length. The roads were of broken stone, screened and laid in courses. The larger stone was at the bottom, the next size above, and the whole covered with screenings. Each course was thoroughly rolled and the top course both watered and rolled.

Particular attention was paid to drainage, and over clay or sandy loam a foundation course consisting of stone laid regularly after the method of Telford or stone laid in a V-shaped trench was used. The subgrade was carefully rolled before placing the broken stone. The foundation varied from 9 ins. to 2 ft. 6 ins. in depth and the broken stone from 3 to 10 ins. in depth.

These methods, except in a few minor details, were used during the 16 years which the writer served on the commission.

Grading Methods on the Toronto-Hamilton Highway in Ontario[*]

By H. S. VAN SCOYOC[†]

In those sections where there were the remains of macadam roadways our first operation was to tear up the subgrade for at least the width of the concrete by means of a scarifier hauled by a gasoline tractor. In most cases the full depth of stone was loosened by one trip, but occasionally more than one was necessary. No difficulty was experienced where bituminous macadam was encountered.

The loose stone was moved to the side to increase the width of the subgrade or to be utilized for shoulder construction or backfilling by means of a grader, unless the cut was so heavy that the material had to be moved some distance. Pick plows or rooters drawn by horses were used to keep the material loose, and the earth was hauled by slushers, wheel scrapers or dump wagons as the distances demanded. If a steam shovel had been near at hand it could have been used to good advantage on some of the Lorne Park hills, but the limited yardages in any one location did not seem to justify the purchase or rental of this kind of equipment.

The slopes, both in cuts and in ditching, were hand trimmed, which added considerably to the cost per cubic yard of excavation, but was necessary if the section was to be maintained. The slopes were made 1½ to 1. Practically all of the removing of sod was done by hand, although graders were used to some extent. Where possible part of the ditching was done with slushers, but much of it was hand work. About five miles of trenching was excavated by a trenching machine. While the limited quantity and the nature of much of the soil trenched did not present ideal conditions for low cost work, a considerable saving was effected in the actual excavation and a much larger saving made indirectly by the reduction in the quantity of material required for backfilling.

Practically all of the subgrade was rolled after the rough grading was completed, and many of the fills were rolled while being made. The stakes to which the side forms were set were utilized for fine grading. In fact, much of the fine grading was done after the side forms were in place. Our industrial railway track added somewhat to the difficulty of our fine grading. This work can not be too carefully done for not only does an even subgrade greatly reduce the danger of cracks, but it insures the proper thickness of concrete at all times and prevents unnecessary waste of concrete. In all cases the subgrade was carefully rolled just previous to the depositing of coarse and fine aggregate for the concrete.

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[*] From a paper entitled "Construction Methods on the Toronto and Hamilton Highway," presented at the Second Conference on Road Construction for County Road Superintendents and Engineers, Toronto, Ont., February, 1916.

[†] Chief Engineer, Toronto and Hamilton Highway Commission.

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Through the courtesy of the publisher of "Good Roads," this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

The 1917 Convention to Be Held at Boston, Massachusetts

The Board of Directors of the Association, as was announced in "Good Roads" for April 22, has decided to hold the 1917 convention at Boston, Mass., during the week beginning February 5. This action was taken at a meeting of the Board held at the Hotel Astor, New York, N. Y., on the evening of April 20.

Invitations to the Association had been received from many cities, among them Philadelphia, Pa., Buffalo, N. Y., Cleveland, O., Atlantic City, N. J., Chicago, Ill., St. Louis and Kansas City, Mo., and New Orleans, La. The selection of Boston was made after the most careful consideration of these various cities and the facilities offered by them for holding the convention and exhibition. One of the factors influencing the choice of Boston was the fact that no meeting of the Association had been held in New England since the second convention of the organization, which was held at Hartford, Conn., in 1904. Another consideration was the position held by the New England states as pioneers in highway improvement and in the development of the state aid principle. Since the inauguration of that plan highway work has gone forward in all of the six states in New England, and much has been done in the development of methods of construction and maintenance.

Another matter which largely influenced the Directors in the choice of a convention city was the availability of Mechanics' Hall in Boston for housing the exhibition and accommodating the technical sessions. The exhibition hall contains upward of 75,000 sq. ft. of floor space, all of which will be available if needed for the exhibition of machinery and materials. On the floor above the exhibition hall is a hall which will be utilized for the meetings. The building is well lighted and heated, and is conveniently situated within a 5 or 10 minutes' walk of the leading hotels.

It is understood that the officials of the Association are busily engaged in the preparation of plans for the show and it is believed by them that the Fourteenth Annual Convention and Eighth National Good Roads Show will bring together more road builders than have ever gathered at a similar convention. The heartiest cooperation of the city and state officers and of local organizations in providing accommodations and entertainment is assured and the coöperation of various road officials and organizations throughout the country is expected. Especial efforts are to be made to get together the greatest road show ever held even by the A. R. B. A.—a show that will include not only the usual valuable and interesting commercial exhibits but also educational exhibits of states, counties, cities, educational institutions and others. The enviable record of the A. R. B. A. in conducting former congresses and shows, and what is known of the plans for the coming congress, assure a national gathering that will merit a record attendance from the West and South as well as from the East.

A. R. B. A. Notes

W. P. Hammersley has been reappointed Superintendent of Streets and Sewers of New Bedford, Mass.

Edward N. Hines, Chairman, Board of County Road Commissioners of Wayne County, Michigan, is expected to speak at a Good Roads Meeting to be held at Battle Creek, Mich., on May 10, 11 and 12.

Amos L. Schaeffer, formerly Consulting Engineer in Charge of Sewers for the Borough of Manhattan, New York City, has been appointed Consulting Engineer of the borough in place of Ernest P. Goodrich, resigned.

Paul D. Sargent, Chief Engineer of the Maine State Highway Commission, was the principal speaker at a good roads meeting held recently at Bangor, Maine. Mr. Sargent's subject was, "Federal Aid and Road Improvement."

Frank F. Rogers, State Highway Commissioner of Michigan, is expected to make an address at a meeting to be held at Battle Creek, Mich., on May 10, 11 and 12 under the auspices of the Michigan State Good Roads Association.

Charles P. Light, who for several years has been Field Secretary of the American Highway Association, has resigned to enter the service of the Fidelity Mutual Life Insurance Co. Mr. Light's resignation took effect on May 1 and he is now connected with the Fidelity company in a managerial capacity, with headquarters at Washington, D. C.

NEWS NOTES

Citizens of Bismarck, N. D., are circulating petitions for 161 blocks of pavement.

Erie County, Pa., has under consideration a plan for road improvements involving the expenditure of $1,125,000.

The Ashley County Good Roads Association was organized recently at Hamburg, Ark. The officers are J. M. Parker, President; E. W. Kimber, Secretary, and B. A. Jackson, Treasurer.

REPORTS

NEW JERSEY COMMISSIONER OF PUBLIC ROADS, 22nd Annual Report; for the year ending Oct. 31, 1915. Cloth, 6x9 ins., 98 pp., illustrated.

This report follows the general style of the New Jersey State Highway Department reports, consisting principally of tabular data on the work in the state at large and detailed reports from each county. A review of the contents of the report was printed in "Good Roads" for February 26.

BALTIMORE COUNTY, MARYLAND. Annual Report of the Roads Engineer for the year ending Dec. 31, 1915. Paper; 6x9 ins., 90 pp. and covers; illustrated, inset tables and maps.

In this report are detailed statements of the year's work in the several districts of the state, tables showing the concrete bridge and culvert work, bridge painting and road oiling, and chapters on state aid work, concrete roads, and machinery. The report is profusely illustrated by halftone reproductions of photographs of improved roads. Two of the tabular statements, one showing details of contract work in the county during 1915, and the other an inventory of road machinery owned by the county, are printed as inserts. A road map of the county showing the state road system, state aid roads, county roads built in 1914, county roads built in 1915, proposed county roads, concrete bridges built in 1914 and concrete bridges built in 1915, is included as an inset.

DEPARTMENT OF PUBLIC HIGHWAYS, ONTARIO, CANADA; "Regulations Respecting Highways, 1916"; Appendix to the Annual Report of the Department of Public Highways. Paper, 6½ x 9½ ins., 12 pp. and covers.

The contents of this consist of the regulations issued by the Department and transmitted under date of March 16 by Deputy Minister McLean. The regulations, as their title implies, cover the entire matter of county road construction, maintenance and repair.

NEW PUBLICATION

METHODS FOR THE DETERMINATION OF THE PHYSICAL PROPERTIES OF ROAD BUILDING ROCK, by Frank H. Jackson, Jr., Assistant Testing Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. Professional Paper, Bulletin No. 347, U. S. Department of Agriculture, dated March 17, 1916. Paper, 6x9 ins., 28 pp. and covers; illustrated.

As is stated in the introduction, this bulletin is a partial revision of a former bulletin prepared by Mr. Jackson and A. T. Goldbeck. It differs from the former bulletin chiefly in that it is limited to a description of the methods employed by the Office of Public Roads for testing road building rock and does not include the results of laboratory tests made by the office. The illustrations consist of reproductions of line drawings of the principal testing machines used.

RELATION OF MINERAL COMPOSITION AND ROCK STRUCTURE TO THE PHYSICAL PROPERTIES OF ROAD MATERIALS. By E. C. E. Lord, Petrographer. Office of Public Roads and Rural Engineering, United States Department of Agriculture. Professional paper. Bulletin No. 348, Department of Agriculture. Dated April 4, 1916. 6x9 ins., 26 pp. and covers. Illustrated.

Included in this bulletin are sections on the examination and classification of rocks for road making, mineral composition of rocks for road making, physical properties of road materials, the general relation between the physical properties of rocks and their mineral composition and structure, and the effect of secondary minerals on the physical properties of road building rocks. The illustrations consist principally of cross sections of various rocks and rock minerals.

PAN-AMERICAN ROAD CONGRESS. Proceedings of the Pan-American Road Congress held under the auspices of the American Road Builders' Association and the American Highway Association at Oakland, California, September 13, 14, 15, 16 and 17, 1915. Paper, 6x9 ins. xv + 416 pp., published by the Executive Committee, Pan-American Road Congress, 150 Nassau St., New York, N. Y.

This volume includes the papers presented at the Pan-American Road Congress, a verbatim report of the discussions following the presentation of the technical papers, reports of committees, various addresses made and other features of the Congress. There is also included a list of donor members of the Congress and an inset illustration showing a group of delegates.

COMING MEETINGS

May 10-12—Michigan State Good Roads Association—Annual meeting, Battle Creek, Mich. Secretary, A. A. Anderson, Hastings, Mich.

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

Change of Date of Meeting of the American Society for Testing Materials

Because of the desirability of avoiding a Saturday forenoon session, the date of the nineteenth annual meeting of the American Society for Testing Materials has been changed. As noted above, the new date is from June 27 to June 30, inclusive. The meeting had formerly been scheduled as June 27 to July 1.

According to the preliminary program, road materials will be considered at the seventh session on the afternoon of Thursday, June 29. At that session the report of Committee D-4, on Road Materials, will be received, and other reports and papers bearing upon road work will be presented. Among these are papers on "Evaporation Loss Tests on Asphalts," by R. O. Fitch, and "Practical Methods for Testing Refractory Bricks," by C. E. Nesbitt and M. E. Bell.

EQUIPMENT — TRADE — MATERIALS

Machine Used in the Department of Public Works, Portland, Oregon, for Cutting Pavement Samples

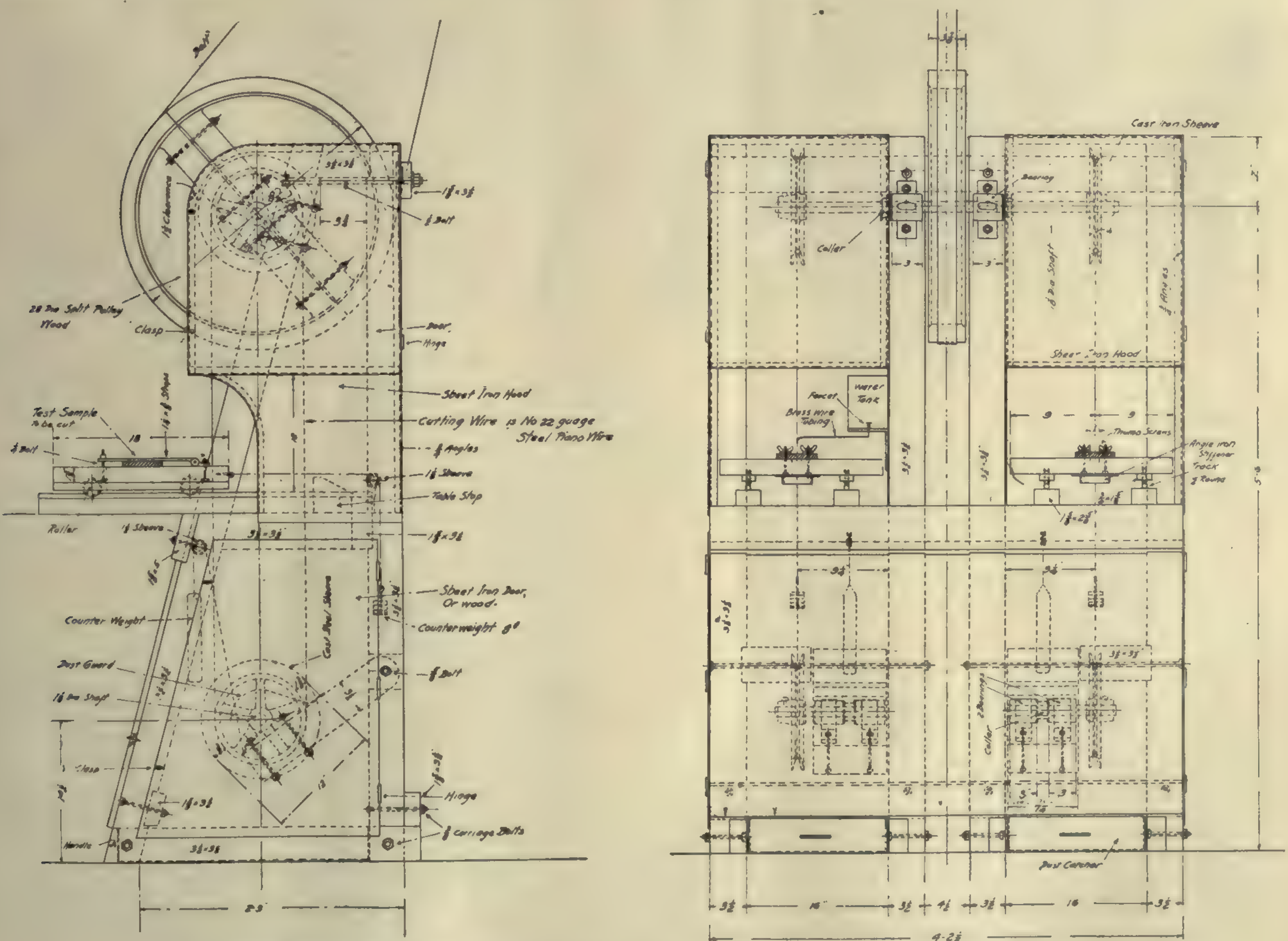
A machine for cutting samples of pavement, has been devised by R. S. Dulin, Chief of the Bureau of Standards of the Department of Public Works of Portland, Ore.

The purpose of the machine is to make cuts through pavement samples to show the cross section—the sizes, shapes and positions of the various particles of mineral aggregate, the condition of the binding material, and the general condition of the test sample. It will cut any type of pavement up to 12 ins. in thickness. Its construction is shown in the accompanying front and side elevations. The machine, as shown, is practically two machines, but can be built as a single machine.

The machine is operated by a belt drive to a pulley mounted on a shaft which carries two cast iron sheaves 13 ins. in diameter. Continuous belts of 22-gauge piano wire pass around these sheaves and around the movable sheaves at the bottom. The sheaves at the bottom are attached to swinging blocks to which are attached counterweights to regulate the tension on the cutting wires. The proper weight to use is determined by experiment. The best cperating speed for the wire is about 450 ft. per minute.

At about 3 ft. from the floor is the cutting table upon which the test sample to be cut is clamped with thumb screws. This table is slotted to permit the wire to run through and is reinforced on both sides of the slot with angle iron stiffeners. The table is mounted on four window pulleys which run on a metal track. A counterweight may be attached to the table to give an automatic feed, but this is practical only with thin specimens. Thick specimens are best cut by being forced against the cutting wire until the wire has been pushed in about 3 ins., then securing the table and leaving it until the wire has cut through a distance of ½ in. The table is then pushed forward again and another cut made. A stop is provided to limit the movement of the table.

During the cutting, emery dust that will pass through an 80-mesh screen is applied to the cutting wire with a brush, at the top of the specimen, while water from a reservoir drops on the specimen at point of cutting. The water reservoir is secured to the framework and has a brass outlet tube extending to the specimen. Emery dust which has been used once can be scraped up and used again and gives results as good as, if not better than, when used the first time. A movable pan made of sheet iron is placed under bottom sheave to catch the emery dust.



Side Elevation.

Front Elevation.

MACHINE USED IN PORTLAND, ORE., FOR CUTTING PAVEMENT SAMPLES.

The framework is built of well seasoned wood of the dimensions shown, fastened with carriage bolts.

The sheaves and bearing are of cast iron. The bearings are babbitted and the sheaves are secured to the shafts with set screws. The upper and lower parts of the machine are incased in sheet iron hoods to prevent dust from flying.

Brazing the cutting wire when a break occurs is done as follows: The ends of the wire are beveled off for about ¼ in., a thin piece of brass is placed between the beveled ends and the joint wrapped with No. 28 copper wire. With borax flux and a blow torch, the wire is brazed and, after being filed to the diameter of the wire, is ready for use.

Bitoslag Pavement

A pavement called "Bitoslag" from the materials of which it is composed—bitumen and slag—has recently been put on the market.

The pavement is the outgrowth of an experiment made in McKeesport, Pa., in the fall of 1910. The pavement laid at that time having given satisfactory service, another one of the same type was laid in the Germantown section of Philadelphia in October of last year. Both the McKeesport and the Philadelphia pavements were laid on old macadam foundation. Bitoslag, however, may be laid on old brick pavements, on old macadam, or on broken stone, slag, or concrete foundations.

BITOSLAG PAVEMENT ON LOGAN STREET IN THE GERMANTOWN SECTION, PHILADELPHIA, PA.

Briefly described, the wearing surface consists of crushed slag, a mineral filler, residuum, and paving cement. The slag, according to the specifications, must be "a carefully selected, hard, air-cooled blast furnace product, so crushed that all particles will pass a ¼-in. screen." It is further specified that it shall be so graded that after the addition of the fine material, the aggregate shall conform to the following mesh composition:

Passing 200-mesh sieve	at least 15%
Passing 100-mesh sieve	at least 25%
Passing ¼-mesh sieve and retained by 20-mesh sieve	at least 45%

The mineral dust or filler must be pulverized so that at least 25 per cent. will pass a 200-mesh sieve, at least 85 per cent. will pass a 100-mesh sieve and none will be retained on a 50-mesh sieve. The residuum, according to the specifications, must be obtained from asphaltic petroleum, must be fluid at 77° F., must have a flash point (open cup method) of over 350° F., must not have a loss of over 5 per cent. when subjected to a temperature of 350° F. for 5 hrs., and after being subjected to that heat must leave a fluid residue. The paving cement must conform to the following specifications:

a. It shall have a specific gravity of not less than 1.03 at a temperature of 77° F.

b. It shall show a flash point by the open cup of not less than 450° F.

c. It shall be soluble in carbon disulphide to the extent of not less than 99.5 per cent.

d. It shall show the following penetrations:
  At 20° F. 200 gram weight 6 seconds, not under 15.
  At 77° F. 100 gram weight 5 seconds, from 25 to 35.
  At 115° F. 50 gram weight 5 seconds, not over 90.

e. It shall show a ductility of not less than 5 nor more than 10 centimeters when tested at a temperature of 77° F.

f. It shall show a melting point when tested by the cube method of not under 180° nor more than 200° F.

g. It shall contain not less than 3 per cent. of sulphur not added before, during or subsequent to refining.

h. It shall not lose over 1 per cent. by weight when heated for 5 hours at a temperature of 325° F. and the penetration of the residue shall not be less than 60 per cent. of the original penetration at 77° F.

i. It shall not be affected by the action of water when coated on a piece of glass and immersed in distilled water in an open vessel at a temperature of 77° F. Any disintegration or discoloration within a period of 7 days shall be considered a susceptibility in this respect.

j. It shall be free from moisture.

In the preparation of the paving mixture the aggregate after being dried and heated to a temperature of 350° to 450° F., is put into the mixer, the necessary amount of filler added cold, and the two materials mixed until uniform. Residuum amounting to 2 per cent. of the weight of the slag and dust is then added and the mixing continued until the residuum is thoroughly incorporated in the mixture. The paving cement which is known as "Improved Bitoslag Paving Cement" is then added in sufficient quantity to uniformly coat all of the particles of the aggregate, and the mixing is continued until the mass is uniform. It is stated that while no definite amount of paving cement can be specified because of the variation permitted in the mesh composition of the aggregate, a satisfactory mixture should show about 9 per cent. of bitumen soluble in disulphide, and that the amount of such bitumen should never be less than 8 per cent. nor more than 11 per cent. The temperature of the paving cement is kept between 250° and 350° F. After the mixing is completed the mixture is carried to the work and dumped at a sufficient distance so that all portions of the load will be rehandled before finally being placed in the pavement. The temperature of the mixture when delivered is between 300° and 400° F. The mixture is spread to such a depth that it will be not less than 2 ins. thick after rolling and is immediately rolled with a tandem roller weighing at least 8 tons. During the rolling a coating of mineral dust or an approved substitute is broomed over the surface, the rolling being continued until the pavement is cool. Traffic is kept off the completed pavement for a period of at least 12 hours.

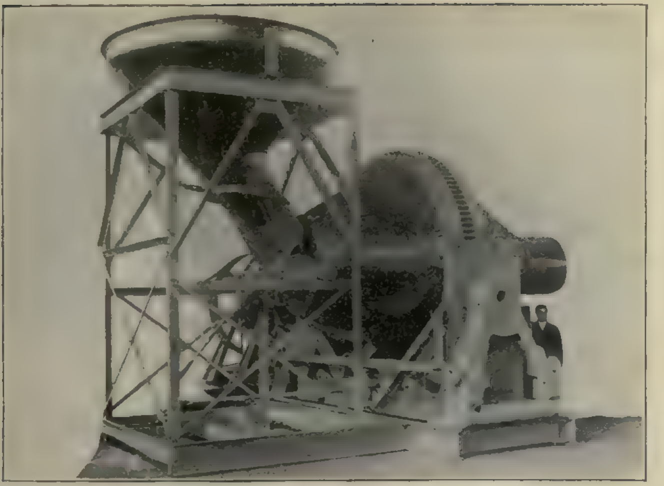
The special claims made for the pavement are that it is durable, economical and non-slippery, and that it utilizes for the aggregate a material which has heretofore been a waste product.

The pavement is covered by patents held by the Bitoslag Paving Co. of New York, N. Y., and may be laid by contractors under licenses obtained from that company.

An Unusual Concrete Mixer

A concrete mixer of unusual size and capacity is shown in the accompanying illustration. The mixer is one of two built to order for some special work by The T. L. Smith Co., of Milwaukee, Wis., manufacturer of the Smith-Chicago mixers and pavers.

The machine was built for the Hardaway Contracting Co., of Washington, D. C., for use in the construction of a concrete dam. The work required mixers of large capacity



CONCRETE MIXER OF UNUSUAL CAPACITY BUILT BY THE T. L. SMITH CO.

and there was not available sufficient space for the four 2-yard mixers which, it was figured, would be needed to turn out the necessary amount of concrete. The company therefore ordered two 4-yard mixers, one of which is shown in the illustration.

Each machine is mounted on steel skids and the hopper is supported on a steel frame. The capacity of the mixer is 108 cu. ft. of mixed concrete per batch or between 150 and 160 cu. ft. of loose, unmixed material. The mixer drum is made of ⅜-in. steel, and the inside diameter of the drum ring is 9 ft. 6 ins. The machine complete weighs 4,600 lbs.

Test of Tractor and Semi-Trailer with Side-Dumping Body

A hauling outfit consisting of a tractor and semi-trailer which was recently tested at Chicago, Ill., is shown in the accompanying illustration.

The tractor is one of the latest 4-wheeled Knox machines, and the semi-trailer a 2-wheeled truck equipped with two Lee two-way side-dumping bodies. The body is of metal and is built to roll upon rails and dump to either side. Except for a small force exerted through a lever at the start, the body dumps entirely by gravity. A complete description of the body was printed in a previous issue of "Good Roads." ["New Two-Way, Side-Dump Motor Truck Body," "Good Roads," Feb. 5, 1916, p. 82.]

In the test referred to, the Knox Model 35 tractor hauled 15 tons of gravel in this trailer at various speeds up to 16 miles per hour. The accompanying illustration shows one feature of the outfit to which the manufacturer calls special attention—the short distance in which the machine can be turned.

KNOX TRACTOR AND SEMI-TRAILER EQUIPPED WITH LEE TWO-WAY, SIDE-DUMPING BODIES.

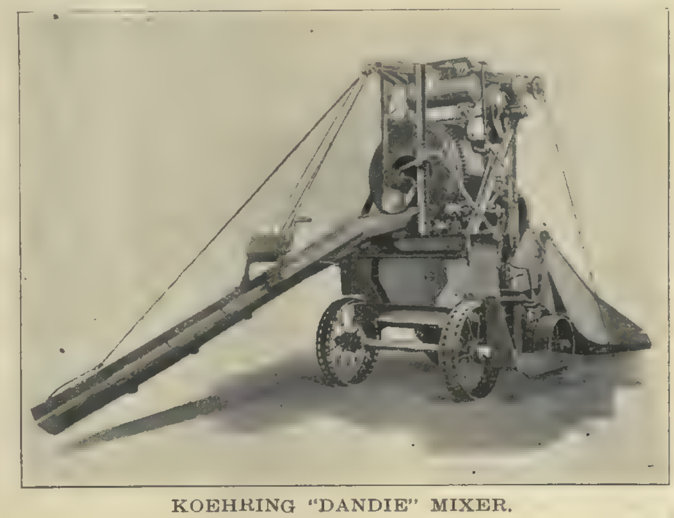
The tractor is made by the Knox Motors Associates, Springfield, Mass., and the dumping body by the Lee Loader Co., Chicago, Ill.

Koehring Puts New Low-Price Concrete Mixer on the Market

The Koehring Machine Co., Milwaukee, Wis., is building a new type of concrete mixer called the "Dandie," which will be strictly standardized and will be turned out in large volume in order to make a low price possible.

For construction purposes the mixer will have a capacity of from 5 to 10 cu. ft., and a high-drum and loading paver will be built in 10 and 20 cu. ft. capacities. The construction mixer is of the low-down type, with platform for wheelbarrow charging, and may be equipped with batch hopper and power loading-skip.

The mixing action is the same as on regular Koehring mixers, with discharge spout extending inside the drum and, in mixing position, forming part of the mixing action. This chute is reversed to discharge. All bearings are constructed on the universal joint principle, and double-drum driving gears are cast from special composition metal. The power loading-skip has an automatic knock-out and brake. The Koehring three-way valve automatic water measuring tank may be had on these mixers.



KOEHRING "DANDIE" MIXER.

In the high-drum pavers the height of the drum affords an unusually great spouting range and makes possible the steep angle that causes fast flow of the mixture.

The loading-skip accommodates two wheelbarrows at the same time. The spout is self-compensating, maintaining the point of discharge at the same distance from the ground regardless of the number of sections in use. The mixers may be used either with gasoline or steam.

"Industrial Arts Index"

An index of technical and industrial periodicals which has a number of unusual features has recently been received. The "Industrial Arts Index," as it is known, is published in February, April, June, October and December of each year. In it are indexed various periodicals, government bulletins and circulars and similar publications. Among these, besides "Good Roads," are several that devote more or less space to the construction of roads and streets. The list includes about a half dozen which devote considerable attention to highways and about twice as many in which an article on that subject occasionally appears.

One of the special features of the index is that each number contains a complete index for the year so that only the latest number need be used. The subscription rate is also unique in that it is graded in accordance with the number of the publications indexed which the subscriber receives.

The subject matter of the "Industrial Arts Index" is printed in alphabetical order, and while in general well arranged, has one very serious defect. The position and typographical appearance of the headings is such as to be misleading unless care is used. While this would be no serious difficulty in the case of one habitually using the index, any one picking up the book for the first time would undoubtedly experience some difficulty in finding the desired information.

The "Industrial Arts Index" is published by the H. W. Wilson Co., White Plains, N. Y.

BOOK NOTICE

GOOD ROADS YEAR BOOK (1916). Cloth, 8vo., viii+440 pp. American Highway Association, Colorado Building, Washington, D. C.

This volume, which is the fifth edition of the Year Book, differs materially from the edition of 1915 in the arrangement of the subject matter, although the character is very little changed. The volume is divided into three parts, as follows: Part I—Information Regarding Road Improvements under Federal, State, Territorial and Local Control; Part II—Historical Notes, Technical Details of Road Construction and Maintenance, European Road Systems; Part III—Miscellaneous. The subject matter of Part I is arranged alphabetically by states and contains résumés of road laws, lists of highway officials and progress reports on work done. The contents of Part II by chapter headings are as follows: History of Road Building; Road Systems of Foreign Countries; Types of Roads; Road Maintenance and Repair; Dust Preventives; Highway Bridges and Culverts; Patented Methods of Road Construction; Digest of State Highway Specifications. The chapter headings of Part III are as follows: Highway Bonds; Bibliography; State Geologists; Manufacturers, Trade Names; Road and Allied Associations.

PERSONAL NOTES

F. D. Richards has been appointed First Assistant City Engineer of Cleveland, O.

X. A. Kramer, Magnolia, Miss., has been elected State Highway Engineer of Mississippi.

John A. Illiman has been appointed County Engineer of Boone County, Ia., in charge of roads and bridges.

H. W. Pettijohn has resigned as Principal Assistant Engineer of the State Highway Department of Washington.

H. O. Hickok has been appointed County Engineer of Marshall County, Ia., with headquarters at Marshalltown, Ia.

John W. Budd has been elected Superintendent of the Department of Streets and Public Improvements, Des Moines, Ia. He was formerly Assistant City Engineer of Des Moines.

Thomas J. Keane, Superintendent of Asphaltic Construction, Pennsylvania State Highway Department, and assistant at the Testing Laboratory of the department, died suddenly, April 25, at his residence in Harrisburg, Pa.

R. T. Stull, Ceramic Engineer of the Dunn Wire-Cut Lug Brick Co., Conneaut, O., has been elected an honorary member of the Paving Brick Institute.

Roy L. Greene has resigned as Deputy County Engineer of Lewis County, Wash., to take a position with the Berg Manufacturing Co., Canton, O. Mr. Greene's headquarters will be in Minneapolis, Minn.

W. A. McTighe, formerly Assistant City Engineer of Memphis, Tenn., has joined the engineering firm of Baum & Haynes, Texarkana, Tex. The firm will be known hereafter as Baum, Haynes & McTighe.

NEWS NOTES

Kansas City, Kan., has awarded contracts for paving amounting to $250,000.

The Roads and Bridges Committee of the Minneapolis, Minn., Council has approved plans for a $100,000 concrete bridge over the railroad tracks at West Lake Street.

City Engineer Macartney of Spokane, Wash., estimates that the city's share of the cost of seven new bridges will be $300,000. The remainder of the $318,600 estimated total cost will be collected from the Water Department and the railroads.

The Sanding of Streets in San Francisco, Cal., last winter resulted in a considerable reduction in the number of accidents caused by the skidding of automobiles on slippery pavements, according to reports. Sand was applied by a spreading machine attached to a motor truck. The spreader was devised by Superintendent of Streets D. J. McCoy.

A Concrete Road from Petersburg to Hopewell, Va., is to be built at a cost of from $115,000 to $120,000. Of this amount $25,000 is being contributed by the duPonts, a like amount by the City of Petersburg and $40,000 by Prince George County, Va. The balance will be raised by private subscription. The road is to be nine miles long and 24 ft. wide.

In Baltimore County, Maryland, 65 dangerous wooden bridges and culverts were replaced by reinforced concrete structures during 1915, according to the annual report for that year of County Roads Engineer William G. Sucro. The total cost of the work was about $26,500. Since 1902, concrete bridges, exclusive of state aid bridges, have been built in the county to the number of 407. The total cost of bridge painting in the county during 1915 amounted to $570.15.

The Part Played by Good Roads in War was one of the topics discussed at a dinner of the American Association of Engineers, held at Chicago, Ill., early in April. M. A. Berns of the publicity department of the Universal Portland Cement Co., the speaker of the evening, is chairman of the publicity committee of the Joint Committee on Military Engineering, an organization recently formed in Chicago. This organization has made plans for lectures by officers of the Engineer Corps of the United States Army, for field demonstrations under the direction of engineering officers of the National Guard and for a correspondence course in military tactics. The secretary is Robert F. Hall, 111 West Washington St., Chicago. An account of the organization of the joint committee was published in "Good Roads" for April 15.

A $375,000 Reinforced Concrete Arch Bridge is being built at Calgary, Alta., to carry Center St. over the Bow River and connect two sections of the city. The bridge proper consists of two 30-ft. spans, four 15-ft. spans, three 150-ft. spans and one 62-ft span. The total length of the bridge and approaches is 1,280 ft., and at the highest point the structure is 42 ft. above the water. The bridge is built on a grade, so that each of the three 150-ft. river spans has a different rise. It will carry a 42-ft. roadway, with a 7-ft. sidewalk on each side. A double track street railway will occupy the central portion of the roadway. A 2½-in. asphalt pavement will be laid directly upon the concrete slabs of the floor system. The work is being done by the city, by day laborers, under the general supervision of City Engineer George W. Craig. According to present plans the bridge will be completed early next fall.

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New Series, Vol. XI.

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Notice to discontinue subscription should be sent to the New York office.

Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Davidson County, Tennessee, to Build a $250,000 Bridge

Bonds to the amount of $250,000 have been issued by Davidson County, Tenn., for the construction of a highway bridge over the Cumberland River, bids for which will be received at Nashville, May 23, by the Hyde's Ferry Bridge Committee of the Davidson County Court.

The bridge will consist of a steel riveted through span of 247 ft., two spans of 197 ft. each and a 180-ft. reinforced concrete approach on concrete piles. The existing piers will be used, but will have to be widened. The roadway will be of brick.

According to the engineers' estimates, the materials required will include 1,450 tons of structural steel, 135 tons of reinforcing steel, 1,920 cu. yds. of concrete, 155 concrete piles, 2,700 sq. yds. of brick paving, 935 cu. yds. of stone masonry and 1,750 ft. of hand railing.

Tennessee Counties Vote Bond Issues for Road Work

Reports received by the State Highway Department of Tennessee indicate that the various counties of the state will expend larger sums of money for road work during 1916 than ever before. Contracts have already been awarded to Blount, Carter, Franklin, Knox and Rhea Counties, where all of the work will be done under bond issues.

The following counties have voted to issue road bonds for the amounts noted:

Claiborne, $300,000; Scott, $300,000; Campbell, $350,000; Carter, $350,000; Greenville, $800,000; Knox, $500,000; Monroe, $325,000; Hawkins, $450,000; Hamilton, $200,000; Grainger, $200,000; Rhea, $250,000; Blount, $400,000; Franklin, $350,000; Lawrence, $350,000; total, $5,125,000.

In addition there will be an election in Morgan County, May 20, on an issue of $100,000. Lincoln and Henry Counties will vote August 3 on issues of $150,000 and $250,000 respectively, and an issue of $100,000 will be voted on in Hardin County on June 3.

State Highway Commission of Mississippi Elects Officers

The State Highway Commission of Mississippi, the formation of which was authorized by comparatively recent legislative enactment, has chosen J. M. McBeath, of Meriden, as Chairman, and W. T. Denman of McComb City, as Secretary.

As noted in the preceding issue of "Good Roads," X. A. Kramer of Magnolia, has been elected State Highway Engineer.

Thirty-four State Highway Contracts to be Awarded in Ohio

The third important letting of Ohio state highway contracts for the season will take place at the State Highway Department, Columbus, on May 19, when bids will be received on 34 separate contracts.

The work is located in 26 counties and the materials specified include water bound macadam, bituminous macadam, surface treated macadam, lignin liquor, concrete and brick, monolithic and semi-monolithic. Most of the contracts include bridge and culvert construction.

Estimates of the total cost of the work amount to approximately $1,295,218.42, depending upon the final decision with regard to the type of construction. The dates set for the completion of the work range from August 1 to December 15.

More State Aid Road Work to Be Let by Illinois Highway Department

The Illinois State Highway Department will receive bids May 17 for additional state aid road work in eleven counties. The construction will cover nearly 24 miles of roads and the types of pavement will include gravel, concrete, bituminous macadam and brick.

The following table shows the different items, the estimated cost of $229,983.70 being exclusive of cement furnished by the state, except in the four cases noted.

County	Type.	Length, ft.	Est. Cost.
Alexander	Gravel	13,120	$19,560.40
Franklin	Concrete	6,416	8,460.48
Carroll	Gravel	8,400	*14,236.00
McHenry (G)	Gravel	10,500	11,791.94
McHenry (H)	Gravel	10,500	*11,811.00
Ogle	Concrete	4,200	17,394.30
Iroquois	Bit. Macadam	12,085	*19,017.00
Iroquois	Bit. Macadam	9,600	17,692.26
Will	Concrete	9,000	25,993.06
Winnebago	Concrete	9,150	19,037.00
Ford	Gravel	13,522	16,118.90
Peoria	Concr. & Brick	11,274	32,659.60
Grundy	Concr. & Bit. Mac.	3,100	5,675.76
Grundy	Bit. Macadam	5,261	*10,536.00
Total		126,128	$229,983.70

*No cement furnished by state.

Federal Aid Bill Passed by the Senate

A bill providing for federal aid to the states in the construction of roads was passed by the United States Senate on Monday of this week. The bill as passed differs in several important particulars from the so-called Shackleford bill which was passed by the House of Representatives on January 25. The Shackleford bill was sent to the Senate and referred to the Committee on Post-Offices and Post Roads and was amended by striking out everything after the enacting clause and substituting other provisions. After a conference with the Agricultural Department the bill was unanimously reported by the Senate committee, and has been discussed at considerable length at various times during the past months. During the discussion several amendments were offered and accepted, among them, a section providing for the construction of roads in the national forests.

A report of the passage of the Shackleford bill was printed in "Good Roads" for Feb. 5. A brief resume of the measure was included therein. ["Federal Aid bill passed by the House of Representatives," "Good Roads," Feb. 5, 1916, page 75.]

The bill as passed is entitled, "An Act to provide that the United States shall aid the states in the construction of rural post roads, and for other purposes." Its main provisions are, in brief, substantially as follows:

The first and second sections authorize the Secretary of Agriculture to cooperate with the states through their respective highway departments in the construction of rural post roads, provided no money apportioned to any state shall be expended therein until the Legislature assents to the provisions of the act, except that until the final adjournment of the first regular session of the Legislature after the passage of the act, the assent of the governor of the state shall be sufficient. The Secretary of Agriculture and the state highway department of each state must agree upon the roads to be built and the method of construction, but all improved roads under the act must be free from tolls. The term "rural post road" is defined as any public road over which the United States mails are now or may hereafter be transported, exclusive of streets and roads in places having populations of 2,500 or more, except that portion of any such road or street along which the houses average more than 200 ft. apart. The term "state highway department" is defined as any department, commission, official or officials of a state empowered to exercise the functions ordinarily exercised by a state highway department. It is also provided that the term "construction" shall be construed to mean the reconstruction and improvement of roads not constructed under the act; that "properly maintained" shall be construed to mean in practically as good condition as when first built, and that necessary bridges and culverts shall be deemed part of the roads covered by the provisions of the act.

Section 3 appropriates the following amounts for the prosecution of the work: For the fiscal year ending June 30, 1917, $5,000,000; for the fiscal year ending June 30, 1918, $10,000,000; for the fiscal year ending June 30, 1919, $15,000,000; for the fiscal year ending June 30, 1920, $20,000,000; for the fiscal year ending June 30, 1921, $25,000,000. Any portion of the amount apportioned to a state for any fiscal year remaining unexpended at the close thereof will be available for expenditure in that state until the close of the succeeding year, except where the state has no highway department, in which case it will be available until the close of the third fiscal year succeeding the close of the fiscal year for which appropriation has been made. Any amount apportioned and remaining unexpended at the close of the period during which it is available must within sixty days after the expiration of that period be reapportioned to all the states in the same manner as if it were being apportioned for the first time.

Section 4 provides that a sum not exceeding 5 per cent. of the appropriation for any year may be deducted for the purpose of administration, the amount to be determined by the Secretary of Agriculture. Any amount left over must be apportioned to the states. The funds available for apportionment are to be divided as follows: One-third in the ratio which the area of each state bears to the total area of all the states; one-third in the ratio which the population of each state bears to the total population of the several states, and one-third in the ratio which the mileage of rural delivery and star routes in each state bears to the total mileage of rural delivery and star routes in all the states.

Section 5 provides that within sixty days after the approval of the act the Secretary of Agriculture shall certify to the Secretary of the Treasury and to each highway department, and to the governor of each state having no highway department, the amount to be deducted for administration and the amount appropriated to each state for the fiscal year ending June 30, 1917, and that thereafter such certification must be made on or before Jan. 20 next preceding the commencement of each fiscal year. Payments for work done are to be made by the Secretary of the Treasury on warrants drawn by the Secretary of Agriculture to authorized officials of each state, the times of payment being determined by the Secretary of Agriculture and the state highway departments.

Section 6 provides that any state which desires to avail itself of the benefits of the act shall, through its state highway department, submit to the Secretary of Agriculture statements of work proposed to be done. If these are approved by the Secretary of Agriculture, the state highway departments must furnish such surveys, plans, specifications and estimates as may be required by the secretary, provided that the secretary may approve only such projects as are substantial in character. If the Secretary of Agriculture approves the plans, specifications and estimates, he must notify the state highway department and immediately certify the fact to the Secretary of the Treasury who must then set aside the proportion payable by the United States, which must not exceed 50 per cent. of the total estimated cost of the work. No payment may be made on any project until the procedure laid down by the law has been carried out nor until there shall have been made available for expenditure by the state on that project money, labor and materials in an amount not less than the amount to be received from the United States, nor until an agreement shall have been made with the Secretary of Agriculture that the state will properly maintain the road. It is further provided that no payment shall be made in excess of $10,000 per mile, exclusive of the cost of bridges of over 20 ft. clear span. It is also provided that the construction in each state shall be carried out in accordance with the laws of that state and under the direct supervision of the state highway department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations made pursuant to the act.

Section 7 provides that the Secretary of Agriculture shall withhold the apportionment of funds to any state in which roads constructed under the act have not been properly maintained by the state if, within six months after he has given written notice to the state highway department, such roads are not properly maintained. The Secretary of Agriculture is also authorized to temporarily refuse to issue warrants upon the failure of any state or its state highway department to comply with the provisions of the act, and to finally decline to issue warrants if within three months after he has given the state highway department written notice, such failure is not remedied to his satisfaction. If this action is taken by the Secretary of Agriculture he must certify the reasons therefor to the Secretary of the Treasury and to the state highway department, and also report the matter to Congress.

Section 8 provides that out of the appropriation made by the act the Secretary of Agriculture is authorized to employ assistants and make other provisions for the administration of the law.

Section 9 authorizes the Secretary of Agriculture to make rules and regulations for the administration of the act.

Section 10 provides that the act shall be in force from the date of its passage.

The clause added by the Senate appropriates $1,000,000 for the fiscal year ending June 30, 1917, and for each fiscal year thereafter up to and including June 30, 1926, for the survey, construction and maintenance of roads and trails within or partially within the national forests when necessary for the use and development of resources upon which the communities within or adjacent to the national forests are dependent; provided that the state, territory or county shall enter into a co-operative agreement with the Secretary of Agriculture for such work upon a basis equitable to both the state, territory or county and the United States, and provided also that the total expenditure in any state, territory or county shall not exceed 10 per cent. of the value, as determined by the Secretary of Agriculture, of the timber and forage resources which are or will be available for income upon the national forest lands within the several respective areas. The funds available under this act are to be available until expended under the supervision of the Secretary of Agriculture upon request from the proper officers of the state, territory or county concerned.

Ohio Awards Contracts for Large Mileage of Highway Work

The Ohio State Highway Department recently awarded contracts for 81.44 miles of highway work in several counties. The amount of the contracts is in excess of $1,100,000. This is the second important letting of the season in Ohio, the result of the first award having been published in "Good Roads" for April 15.

The general character of the work in each section, together with the names of the low bidders and the amounts of their bids, are noted below.

Champaign County, Urbana-West Jefferson road, water bound macadam; 1.56 mile, S. W. Wrightdel, Logan, $12,566.90.

Clarke County, Springfield-Urbana road, 4.35 miles, Sylvester Baughman, Marysville, surface-treated macadam, $44,528.10, water bound macadam, $39,626.58.

Columbiana County, Cleveland-East Liverpool road, bituminous macadam, 3.01 miles, Public Contracting Company, Elyria, $32,750.

Crawford County, Bucyrus-Galion road, brick (monolithic), 1.69 mile, L. R. McMichael, Bucyrus, $31,800; Bucyrus-Marion road, 1.03 mile, L. R. McMichael, Bucyrus, brick (monolithic), $19,400; semi-monolithic, $20,500; Columbus-Sandusky road, brick, 0.5 mile; A. J. Brady and J. C. Drake, Marion, $10,560.

Delaware County, Columbus-Sandusky road, 0.97 mile, S. C. & Stewart Kisner, Delaware, macadam, $11,620.30; reinforced concrete, $14,179.50; Delaware-Mt. Gilead road, 3.72 miles, Brewer, Tomlinson & Brewer, Chillicothe, macadam, $36,662; reinforced and plain concrete, $35,860; Columbus-Sandusky road, 1.9 mile, S. C. & Stewart Kisner, Delaware, macadam, $21,563.30, concrete, $30,369.61.

Franklin County, Columbus-Sandusky road, brick (semi-monolithic), 0.76 mile, Culbertson & Culbertson, Richmond, Ind., $47,848.

Geauga County, Burton-Bloomfield road, concrete, 2.97 miles, L. H. Young Contracting Co., West Austintown, $35,033.36; Chagrin Falls-Greenville road, 2.50 miles, Farrell Engineering & Construction Co., Cleveland, concrete and brick, $28,153.85; Enterprise Paving & Construction Co., Cleveland, brick, $28,348.02.

Greene County, Dayton-Chillicothe road, water bound macadam, 5.67 miles, McGarry & Sparks, Columbus, $30,500.

Jefferson County, Skelly-Empire road, water bound macadam, 0.90 mile, W. R. Heburn, Mt. Pleasant, $14,358.95.

Jefferson County, Ohio River road, brick, 0.72 mile, Springer & Springer, Wheeling, W. Va., $21,471.

Knox County, Mt. Vernon-Coshocton road, 2.06 miles, Mansfield Construction Co., Mansfield, water bound macadam, $21,678; bituminous macadam, $25,108.83; Columbus-Millersburg road, 4.18 miles, Mansfield Construction Co., water bound macadam, $47,510, bituminous macadam, $55,553.

Logan County, Urbana-Bellefontaine road, water bound macadam, 4.15 miles, D. R. McArthur and D. C. Fox, Belle Center, $25,744.52.

Mahoning County, Youngstown-New Bedford road, water-bound macadam. Length 1.31 mile, Evans Bros., Hubbard, $10,864.08.

Mercer County, Celina-Greenville road, reinforced concrete, 3.08 miles, Joseph and Lisle Karsh, Celina, $45,314.47.

Miami County, Dayton-Troy road, 5.03 miles, C. E. Williams, Grand Rapids, Mich., bituminous macadam, $52,326; J. A. Westrick, Holgate, reinforced concrete, $70,545.50.

Monroe County, Woodsfield-Marietta road, bituminous macadam, 1.92 mile, Abner Juniper & Son, Nelsonville, $33,000.

Muskingum County, Zanesville-Caldwell road, brick, 1.35 mile, C. W. Hughes and C. K. Smith, Malta, $23,680.51.

Portage County, Cleveland-East Liverpool road, brick, 2.40 miles, Morgan Bros., Ravenna, $40,300.

Ross County Chillicothe-Lancaster road, brick, 1.02 mile, Brewer, Tomlinson & Brewer, Chillicothe, $12,973.73.

Stark County, Akron-Canton road, brick, 5.78 miles, J. B. Smith, J. C. Krabill and J. E. Siffert, Canton, $124,452.44.

Tuscarawas County, New Philadelphia-Uhrichsville road, brick, 2.37 miles, Pace Bros., Cleveland; $44,155.

Union County, Urbana-Marysville road, reinforced concrete, 0.21 mile, John L. Porter, Marysville, $3,133.48.

Washington County, Marietta-McConnellsville road, 0.80 mile, McElfresh, Danford & Glover, Caldwell, tar macadam, $12,996; asphalt macadam, $13,362; Athens-Marietta road, 1.23 mile, Engineering Service Co., Columbus, tar macadam, $18,250; asphalt macadam, $18,829.

Wood County, Bowling Green-Perrysburg road, 4.77 miles, Gray Bros., Bowling Green, bituminous macadam, $33,500; asphalt concrete, $38,000; Bowling Green-Perrysburg road, 5.98 miles, Gray Bros., Bowling Green, bituminous macadam, $39,400; asphaltic concrete, $46,400; bituminous concrete, $44,000.

Ashland County, Ashland-Loudenville road, resurfacing and water bound macadam, 1.55 mile, Gallagher & Aaron, Youngstown, $17,859.17.

Inter-County Steel Bridge in Oregon to Cost $198,400

Plans for a bridge to be erected by Marion and Polk Counties, Ore., have been prepared under the direction of State Engineer John H. Lewis, and have been submitted to the county authorities for approval.

The plans provide for a 130-ft. vertical lift span and four 161-ft. camel back steel spans, with an 850-ft. reinforced concrete viaduct approach on the Polk County end. The lift span will be balanced by counterweights and operated by rack and pinion gearing, electric driven. The floor of the main spans will be of wood on steel joists and will have a bituminous surface. The roadway will be 26 ft. wide with a 6-ft. sidewalk on each side.

According to estimates, the cost of the steel structure, including foundations, will be $143,000, while the estimated cost of the concrete viaduct approach is $55,400.

Varieties of Trees for Planting Along Streets and Highways

The State College of Forestry, Syracuse, N. Y., has made public two recent reports regarding the planting of trees along city and village streets and country roads.

Depending upon the width of the street and the open space between other trees, one report states that newly planted trees should be set not less than 30 ft. apart along city streets and preferably from 50 to 60 ft. The varieties best suited to city conditions are red oak, pin oak, Norway maple, silver-leaf linden and oriental sycamore. Trees measuring about 2 in. in diameter 3 ft. above the ground, and from 10 to 12 ft. high, are most satisfactory.

For village streets, the college recommends the Norway maple, American linden, scarlet oak, American white ash, American elm, sycamore and red oak. Nursery grown trees with straight stems and no branches less than 6 to 8 ft. from the ground, are preferable to trees taken from local wood lots.

The reports state that the criticism of shade trees along rural highways absorbing soil nutrition needed for crops cannot hold when trees which send their roots deep into the ground are used. The oak and the ash are most suitable where land on either side of the road is used for crops. Where windbreaks are needed, the evergreen trees are valuable.

COMING MEETINGS

May 15-16—Arizona Good Roads Association.—Annual meeting, Phoenix, Ariz. Secretary, Harry Welch, Phoenix, Ariz.

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 13-14—Intermountain Good Roads Association.—Annual convention, Ogden, Utah. Secretary, O. J. Stilwell, Ogden, Utah.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

American Society for Testing Materials

The annual meeting of the American Society for Testing Materials will be held at the Hotel Traymore, Atlantic City, N. J., June 27 to 30. The program is in course of preparation.

The Nominating Committee has reported the following nominations which will be submitted to the convention: For President, A. A. Stevenson; for Vice President, S. S. Voorhees; for Members of the Executive Committee, W. H. Bassett, John Brunner, G. W. Thompson and F. E. Turneaure.

The following officers hold over for another year: Vice President, W. H. Bixby; Members of the Executive Committee, J. H. Gibboney, W. K. Hatt, J. H. Mathews and Edward Orton, Jr.

Intermountain Good Roads Association

The annual convention of the Intermountain Good Roads Association will be held at Ogden, Utah, June 13 and 14, as noted above, and will be attended by delegates from the member states of Idaho, Montana, Nevada, Utah and Wyoming.

The County Commissioners of Weber County, Utah, of which Ogden is the county seat, are taking an active interest in the coming meeting, a feature of which will be an inspection of the extensive road work in progress in the county.

PERSONAL NOTES

Paul Riston has been elected City Engineer of Punxsutawney, Pa.

William F. Cocke has been appointed State Road Commissioner of Florida.

Frank H. Zouck has been appointed Chairman of the Maryland Roads Commission.

J. Ellingston, City Engineer of Sherman, Tex., has been made City Manager.

E. B. Hessler has been appointed Second Assistant City Engineer of Reading, Pa.

E. I. Cantine has been retained as Assistant State Highway Engineer of Oregon, by unanimous vote of the State Highway Commission.

John Love, Sweetwater, Tenn., has been elected Highway Engineer of Monroe County, Tenn. He will have charge of road work under a $325,000 bond issue.

Charles S. Grace, Junior Resident Engineer of the California State Highway Commission, has resigned to become Junior Engineer of the Los Angeles, Cal., Flood Control District.

Henry W. Dun, Jun. Am. Soc. C. E., has resigned as Assistant Engineer in the office of the City Engineer of Albany, N. Y. He will enter the Engineering Department of the Atchison, Topeka & Santa Fe Railway.

NEWS OF THE TRADE

The steam shovel interests of the Ball Engine Co., Erie, Pa., are now represented in the Chicago, Ill., district by J. A. Garber, 1540 Monadnock Building.

The Municipal Engineering & Contracting Co., Chicago, Ill., has issued a booklet entitled "Concrete Mixers," describing the Austin cube mixers. The publication is illustrated and handsomely printed in two colors.

The Southern Clay Manufacturing Co., Chattanooga, Tenn., has purchased the Graves paving brick plant at North Birmingham, Ala., where it will make wire-cut lug paving brick. The company already has plants at Robbins, Tenn., and Coaldale, Ala.

Polk County, Fla., will vote June 1 on a proposed bond issue of $1,500,000 for constructing about 220 miles of roads.

The Board of Supervisors of Lincoln County, Miss., has voted to issue bonds to the amount of $200,000 for the purpose of graveling 175 miles of roads.

Washington County, Miss., is planning to construct 150 miles of roads and will have an election June 14 on a bond issue of $950,000 to defray the cost.

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Notice to discontinue subscription should be sent to the New York office.

Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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THE COST OF PHOTO-ENGRAVING

While this matter is not very closely allied with road building, it is of vital importance to publishers of trade journals and to their advertising patrons. This short statement is published in order that all readers of "Good Roads" may be informed of a situation which, until Tuesday of this week, bade fair to become intolerable.

The photo-engravers of New York City, in an organization known as the Photo-Engravers' Board of Trade, recently notified all publishers in New York City of advances in the prices for photo-engravings ranging from 20 to 200 per cent. It is noteworthy in this connection that a similar scale has been in effect in Chicago, Ill., and was planned for 34 other cities.

The New York Trade Press Association brought the matter to the attention of the District Attorney of New York County, alleging not only violation of the federal law against combinations to fix prices, but of the state law known as the Donnelly Act. After hearing representatives of both sides, District Attorney Swann expressed his conviction that the Donnelly Act had been violated by the photo-engravers and planned to bring the matter to the attention of the Grand Jury on Wednesday of this week.

On Tuesday representatives of the Photo-Engravers' Board of Trade again appeared before District Attorney Swann and, while persisting in their contention that no anti-trust law had been violated by their organization, agreed to Judge Swann's terms that the combination be dissolved forthwith.

What effect, if any, the dissolution of the Photo-Engravers' Board of Trade will have on the new scale of prices remains to be seen. A further increase is talked of in some quarters.

Legislation to Facilitate the Extension of Foreign Trade

A measure which should be of interest to American manufacturers of road machinery, materials and equipment has been proposed by the Federal Trade Commission.

The object of the proposed law is to so amend the Sherman Anti-Trust Law and supplementary laws as to make legal the combination of American business men for the purpose of extending export trade, employing "any methods of organization which do not operate to the prejudice of the American public and are lawful in the countries where the trade is to be carried on."

Such combination is lawful in most of the leading foreign countries, and it is believed that at the end of the war American manufacturers should be in a position to compete on equal terms with those of other countries.

Macadam Road Construction in Jackson County, Missouri

The authorities of Jackson County, Mo., have received bids for the construction of approximately 140,000 sq. yds. of macadam construction on five county roads.

These are the Swope Park-Hickman Mills Road, the Owens School House-Lake City Road, the Frank Frick Road, the C. A. Duck Road and the Valley Road. The low bids for the five contracts aggregate $153,086.15.

The details of the work, which involves among other things, 38,830 cu. yds. of solid rock excavation on two of the roads are given below:

Excavation and material	Swope Park	Owens Road	Frick Road	Duck Road	Valley Road
Earth, cu. yds......	17,517	33,144	5,487	21,327	30,074
Solid rock, cu. yds..	18,830	......	......	20,000	......
Loose rock, cu. yds.	1,800	......	......	7,335	......
Macadam, sq. yds..	9,200	45,472	10,814	33,964	......
Concrete, cu. yds..	35	70	......	61	10
Riprap, sq. yds..	......	......	5,500	8,500	......

Ambitious Road Building Program Advocated in Fresno County, California

In a report to the Board of Supervisors of Fresno County, Cal., the Fresno County Highway Commission recommends holding a special election for the purpose of voting on a bond issue of $3,600,000, to be used for the construction of a system of permanent highways throughout the county.

The plans of the commission include the construction of 441 miles of asphaltic surfaced highway on a 5-in. concrete base, 98 miles of mountain roads and 108 miles of gravel base roads. The specifications call for a 16-ft. roadway in all except two cases.

Estimates submitted by the commission call for expenditures of $2,492,730 for the concrete base roads, $40,000 for the mountain roads, $540,000 for the gravel base roads, $200,000 for bridges and culverts and $327,270 for engineering and administration. W. S. Farley is the highway engineer in charge for the commission.

Samuel Hill, Back from Europe, Says End of War is Near

Samuel Hill, Former President of the American Road Builders' Association and Honorary Life President of the Washington Good Roads Association, returned from Europe recently, completing his thirty-ninth round trip across the Atlantic. Mr. Hill arrived in Liverpool, England, on the American Line steamer Philadelphia, May 1, and sailed for New York on the same steamer May 6.

Between the time of the arrival and departure of the Philadelphia, Mr. Hill crossed to France, dined with King Albert of Belgium, at his headquarters, visited the firing line in Western France and Flanders and returned to London, where he conferred with cabinet ministers. He went to Scotland, visited the British fleet, viewed the English harbor protections against submarines and reached Liverpool a few hours before the Philadelphia sailed for New York.

In an interview on his arrival in New York, Mr. Hill asserted that the war would end as suddenly as it started in August, 1914. He said:

"There will not be another winter campaign. Germany cannot struggle against the overwhelming financial strain and the economic conditions prevailing since the war.

"In 1913 Germany imported 500,000 laborers to harvest her crops, and this year she will only gather in 60 per cent. of the harvest of the year before the war.

"King Albert, whom I have known personally for 20 years, was in excellent health and confident of having his country restored to him at the end of the war, which in France and England is regarded as a certain victory for the Allies. The French people have got living down to a practical economic basis. They eat only sufficient food to sustain them in health.

"When the Philadelphia got alongside the Liverpool landing stage early Monday morning I was permitted to leave at once for London, where I drove at once to the French Embassy, presented my credentials from Ambassador Jusserand and the State Department, and obtained a special permit to travel that night to Paris via Southampton and Havre, which is prohibited generally to neutrals, who have to go by Folkestone and Dieppe.

"On my arrival at Havre on Tuesday forenoon I drove to the capital of Belgium, which is called Nice Havraise, and saw the Minister of Justice, who telephoned to Paris and arranged for my visit to King Albert. Before taking the train for Paris I was taken for a 25-mile automobile drive outside Havre, where the crops are abundant. Not a square inch of ground has been left uncultivated. I saw more vegetation in that ride than I did afterward in the whole of my trip through England and Scotland.

"I slept in Paris on Tuesday night and started early Wednesday morning in the direction of Dunkirk. There were no cabs in the French capital, and the porter had to carry my bag to the hotel while I followed on foot.

"When I left the train at a small station, of which I may not give the name, I was met by an aide de camp with an automobile. There was a soldier chauffeur in front, and the officer and myself sat in the tonneau.

"I do not know the make of the car, but it went at a speed I had never traveled before, over hills, streams, and plains, never stopping, for nearly five hours. Our average speed was fifty-five miles an hour, and we were seventy-five to eighty miles on the down grades. At every main road crossing soldiers covered us with their rifles, but fell back as the officer made them a sign. This scared me frequently, as I felt that he might make a mistake in the sign and the soldiers would fire on us without stopping for inquiries.

"It was about 4 o'clock on Wednesday afternoon when we arrived at the small village near Lappin, where King Albert and Queen Elizabeth were staying at that time. I had a conference with his Majesty which lasted three hours, and then had dinner with him. The Queen and a Belgian general were the only others present. The meal was a very simple one, consisting of soup and roast chicken, with salad and dessert. There was no wine on the table. After dinner I talked with King Albert until 10:30 o'clock, and then drove off in the automobile to a small ramshackle house, where I slept until 4 o'clock next morning in a sparsely furnished room.

"At that hour I was awakened by a rocking sensation accompanied by a heavy booming, which I discovered to be the Germans saluting the dawn. The King had promised that I was to see something of the firing lines, and he kept his word. After breakfasting on eggs, bread and coffee I drove some distance in the automobile until apparently we came quite close to the German guns and saw the Belgian soldiers in the distance, scattered in twos and threes, lying on the ground. I remained there until 8 o'clock, when King Albert and his staff arrived, with the Queen, in the rear of the firing lines.

"After leaving the Belgian battlefront I drove in the King's automobile at the same terrific speed for about 200 miles to Boulogne, where I had a special permit to cross over to Folkestone on one of the British transports."

Michigan Supreme Court Upholds Motor Horse-Power Tax

That a fresh impetus will be given road building in Michigan, as a result of the recent Supreme Court decision, upholding the constitutionality of the so-called Newell Smith horse-power tax on motor vehicles, is the opinion of State Highway Commissioner Rogers.

Under the law, the counties will receive 50 per cent. of the tax. The first apportionment will amount to $137,565. Forty counties have thus far been designated to receive a part of this sum. The apportionments are as follows:

Benzie, $740; Berrien, $26,553; Calhoun, $500; Cass, $928; Crawford, $3,179; Dickinson, $1,986; Eaton, $1,038; Grand Traverse, $750; Gratiot, $1,800; Hillsdale, $846; Huron, $5,549; Ingham, $248; Isabella, $1,092; Kalamazao, $258; Kent, $3,352; Keweenaw, $9,272; Lapeer, $250; Leelanau, $1,540; Livingston, $1,719; Luce, $671; Macomb, $1,464; Mecosta, $379; Menominee, $8,325; Midland, $2,877; Missaukee, $890; Newaygo, $200; Oakland, $3,829; Oceana, $1,931; Ogemaw, $1,322; Osceola, $1,306; Ottawa, $2,184; Saginaw, $3,400; Sanilac, $1,600; Shiawassee, $996; St. Clair, $6,726; St. Joseph, $600; Tuscola, $3,891; Van Buren, $5,877; Wayne, $14,730; Wexford, $7,215.

Next Wednesday to be Observed in Utah as Good Roads Day

Wednesday of next week, May 2, will be observed as Good Roads Day throughout the State of Utah, Governor William Spry having issued a proclamation to that effect.

According to reports received by State Road Engineer E. R. Morgan, nearly all counties are showing much interest in the movement. In Salt Lake County, the Commercial Club and the Rotary Club of Salt Lake City have taken charge of the arrangements.

Paving in Salt Lake City, Utah

The City Commission of Salt Lake City, Utah, has adopted a program of public improvement including considerable paving and curb and gutter construction.

According to estimates, the city's share of the cost will be $159,189. Of this amount, $117,324 will come out of this year's revenue and the balance out of next year's.

The Authorities of Belmont County, O., will call an election for the purpose of voting on a proposed issue of $1,000,000 road bonds.

West Virginia Counties Have Voted Bonds for More Than $7,000,000

Twenty-two of the 55 counties of West Virginia have voted to issue bonds to the amount of $7,748,500 for the construction of good roads since February, 1911, according to data prepared by the State Road Bureau.

Of this amount $2,488,500 was provided for at elections held since the beginning of the present year and all of these bonds have not yet been sold.

The individual amounts voted range from $40,000 to $600,000. The following table shows the counties and districts for which the bonds were issued, the dates of the elections and the amounts of issue.

Date	County	District	Amount
Feb. 1911	Wood	Parkersburg	$180,000
May 1911	Cabell	....	300,000
Oct. 1911	Hancock	Grant	125,000
Nov. 1912	Hancock	Butler	125,000
Nov. 1912	Marshall	Union	150,000
May 1913	Marion	Fairmount	400,000
Jun. 1913	Marion	Mannington	300,000
Dec. 1913	Mercer	....	500,000
Dec. 1913	Pleasants	Washington	60,000
Mar. 1914	Wood	Williams	70,000
May 1914	Wood	Clay	40,000
May 1914	Hancock	Clay	40,000
Mar. 1915	McDowell	Big Creek	165,000
May 1915	Cabell	....	600,000
May 1915	Kanawha	Poca	25,000
May 1915	Kanawha	Union	50,000
May 1915	Kanawha	Jefferson	90,000
May 1915	Kanawha	Malden	45,000
May 1915	Kanawha	Charleston	80,000
May 1915	Kanawha	Louden	85,000
May 1915	Mercer	....	350,000
Jun. 1915	Marion	Fairmount	100,000
Aug. 1915	Summers	Talcott	100,000
Aug. 1915	Summers	Greenbrier	150,000
Aug. 1915	Wyoming	....	550,000
Sep. 1915	Monongalia	Morgan	300,000
Dec. 1915	Preston	Portland	280,000
Jan. 1916	Preston	Kingwood	164,000
Jan. 1916	Upshur	Buckhannon	181,000
Mar. 1916	Doddridge	West Union	200,000
Mar. 1916	Hancock	Pee	50,000
Mar. 1916	Randolph	Leadsville	220,000
Apr. 1916	Raleigh	Town	300,000
Apr. 1916	Raleigh	Trap Hill	175,000
Apr. 1916	Raleigh	Shady Springs	135,000
Apr. 1916	Raleigh	Slab Fork	210,000
Apr. 1916	Barbour	Barker	130,000
Apr. 1916	Roane	Spencer	240,000
Apr. 1916	Greenbrier	White Sulphur	90,000
Apr. 1916	Wetzel	Church	240,000
Apr. 1916	Greenbrier	Lewisburg	153,500
Total			$7,748,500

Free Parking Space for Automobiles in St. Louis, Missouri

In connection with street traffic regulation in St. Louis, Mo., free parking spaces are being built for automobiles to take care of conditions which will prevail under the recently adopted ordinances regulating traffic. Work on the new parking spaces was started May 7.

The new regulations become effective on May 27 and prohibit the parking of all automobiles, with the exception of licensed taxicabs, for a longer period than two hours in the streets of the congested district.

All of the streets in this district will be designated by red signs placed under all street signs at intersections.

Washington County, Tenn., has voted against the workhouse system of building roads.

The City Council of Mount Ayr, Ia., has adopted a program calling for the paving of 109 blocks of streets.

New York State Using Convicts on Road Maintenance Work

A detail of 16 convicts from the state prison at Auburn, N. Y., has been employed on maintenance work on the section of the New York State highway system between Auburn and Syracuse.

This is in the nature of an experiment by the State Highway Department, as it is the first time this class of convicts has been employed on work of this character in New York State.

Later in the month, if the experiment proves successful, it is understood that the gang will be increased to 96 men and divided into six sections.

COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 13-14—Intermountain Good Roads Association.—Annual convention, Ogden, Utah. Secretary, O. J. Stilwell, Ogden, Utah.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

Conference of New York State Mayors

The seventh annual Conference of Mayors and Other City Officials of New York State will be held at the Onondaga Hotel, Syracuse, N. Y., on May 31 and June 1 and 2. An address will be made by Secretary of State Francis M. Hugo.

There will be six sessions of the conference and the following officials will preside at the different sessions in the order in which their names are printed: Mayor Samuel Carlson, Jamestown; State Comptroller Eugene M. Travis, Mayor Walter Butler, Saratoga; Mayor Julius Frank, Ogdensburg; Mayor George R. Lunn, Schenectady, and Mayor Benjamin L. Rand, North Tonawanda.

MEETINGS

Michigan Good Roads Association

The 13th annual convention of the Michigan State Good Roads Association was held in the Post Theater, Battle Creek, Mich., May 10 and 11, with a good attendance. The opening address was made by Governor W. N. Ferris of Michigan. Mayor James Marsh of Battle Creek welcomed the delegates. The sessions were presided over by Philip G. Colgrove of Hastings, President of the association, who, in his annual address, stated that by the end of the present fiscal year, Michigan will have fully 4,200 miles of roads completed for state reward.

Aside from the consideration of several papers which were presented, the principal business of the convention was the election of officers and the adoption of an amended constitution.

President Colgrove, who has held office for seven years, was reelected. The other officers chosen were M. P. Hull Dimondale, Vice President; A. A. Anderson, Hastings, Secretary, and J. Edward Roe, Lansing, Treasurer.

An exhibit of machinery and materials was arranged in a tent near the Post Theater.

Officers elected by the Good Roads Association of Wisconsin, which was organized at a meeting held April 13, at Milwaukee, Wis., are as follows: President, C. C. Jacobus, Wauwatosa; Vice President, Elmer S. Hall, Green Bay; Secretary, William H. Reese, Milwaukee; Treasurer, Ernest J. Perry, Fond du Lac.

PERSONAL NOTES

George H. Randall has been appointed City Engineer of Oshkosh, Wis.

August Klockow has been appointed Superintendent of Streets of Mt. Clemens, Mich.

H. J. McGregor has been appointed Superintendent of Streets and Bridges of Tacoma, Wash.

William Powrie, City Engineer of Waukesha, Wis., has been elected President of the Board of Public Works.

Edward Guilfoyle has resigned as Superintendent of Streets of Binghamton, N. Y., to engage in private business.

Col. Christopher L. Avery, Groton, Mass., has been appointed a member of the Massachusetts Rivers, Harbors and Bridges Commission.

J. E. Gillespie, Division Engineer of the Wisconsin Highway Commission at Grand Rapids, Wis., has been transferred to the Milwaukee Division.

Lester Kirschbraun, a consulting engineer of Chicago, Ill., has been retained by the City Council of Beloit, Wis., to supervise the execution of the city's 1916 paving program.

Dr. Elmer L. Corthell, of North Egremont, Mass., President of the American Society of Civil Engineers, died May 16, at a hospital in Albany, N. Y. He had been ill for several years.

Frank D. Lyon, former Deputy State Highway Commissioner of New York, has been appointed Superintendent of Streets of Binghamton, N. Y., to succeed Edward Guilfoyle, whose resignation is noted elsewhere in this column.

NEWS OF THE TRADE

The Peoria Tractor Co., Peoria, Ill., has issued a large illustrated wall hanger, describing the Peoria tractor.

The Good Roads Machinery Co., Inc., Kennett Square, Pa., has just issued Bulletin K.A.H., describing the Good Roads concrete mixers. The bulletin is in booklet form and is illustrated.

The Imperial Contracting Co. has been incorporated at Wilmington, Del., with a capital stock of $25,000. The incorporators are James A. Mahaffey, Homer Coffin and Norman P. Coffin, all of Wilmington.

The Gray Construction Co., Morristown, N. J., has been incorporated under the laws of New Jersey, with a capital stock of $100,000. Rudolph Hermes, Jr., Whippany Road, Hanover Township, is statutory agent. The company will build and repair roads and undertake other contracting work.

NEWS NOTES

Nassau County, N. Y., is planning a $200,000 highway from Rosedale eastwardly to Massapequa. The road is intended to relieve congestion on the Merrick Road.

Mahoning County, Ohio, is planning to build a 2,840-ft. viaduct across the Mahoning River at Youngstown, O. The cost is estimated at $300,000 or more.

The City Council of St. Paul, Minn., has set June 22 as the date for a hearing to determine the advisability of paving portions of three streets at an estimated cost of $166,317.

Governor McCall of Massachusetts has signed a bill authorizing the Essex County Commissioners to borrow $200,000 for reconstructing and widening the Essex Bridge between Salem and Beverly, Mass.

The Chamber of Commerce of Quincy, Ill., has offered a 24-ft. stone culvert as a prize to the township of Adams County doing the most road work in course of a week. County Superintendent of Highways L. L. Boyer suggested the plan.

Parkersburg, W. Va., recently celebrated the opening of a new $500,000 bridge across the Ohio River. Senator William E. Chilton of West Virginia was one of the speakers, and former Governor White presided at a banquet attended by about 500 persons.

A Plan is Under Consideration in Hamilton, O., to improve all approaches to the city at an estimated cost of $302,000. The matter has progressed to a point where the City Council is considering the advisability of submitting the question of a bond issue to a vote of the electors.

Snow Removal in New York City During the Past Winter has recently been made the subject of an attack upon the Street Cleaning Department by the Bureau of City Inquiry of New York. The bureau's director, William Bullock, is credited with the statement that over $1,000,000 was wasted in one way and another in the prosecution of the work and that the cost of snow removal last winter, approximately $2,500,000, was the highest in the history of the city. He also asserts, it is stated, that a total of 2,483,413 cu. yds. of snow was removed by contractors and that the contractors received $858,218.57 for the work. This amount, he claims, should have been taken care of for $456,593.69, at the regular city rate for bricks plus $134,750 additional to cover the cost of loading. In reply to these charges Street Cleaning Commissioner Fetherston is quoted as follows: "Two years ago, when the old system of snow removal by trucks was in force, 5,000,000 cu. yds. of snow were removed at a cost of $2,500,000, or 50 cts. a cu. yd., in round figures. Last winter about 10,000,000 cu. yds. of snow were removed, at a cost of $2,300,000, or 23 cts. a cu. yd. Under the new system of using automobile snow ploughs and sewers for snow removal during the storm, the truck removal after the storm, streets were cleared at about four times the speed and at half the cost of previous methods."

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Bay County, Michigan, Adopts Patrol System of Road Maintenance

At a recent meeting of the County Road Commission of Bay County, Mich., it was decided to adopt the patrol system of maintenance for the county roads.

The system will be tried out on the Midland, Quanicassee, AuSable, Beaver, Linwood and Saginaw Roads and will subsequently be extended to cover all roads in the county.

William J. Locke Appointed State Highway Commissioner of Florida

The State Road Department of Florida, which was created by act of the 1915 Legislature, has appointed William J. Locke, of Richmond, Va., State Highway Commissioner. Mr. Locke, who was formerly State Highway Commissioner of Virginia, assumed office at a meeting of the department on May 19.

Under the law creating the department, the state highway commissioner is appointed by the five members of the department and is the executive official of the organization.

Chicago, Illinois, Engineers to Participate in Preparedness Parade

Engineers will take a prominent part in the parade which will take place in Chicago, Ill., June 3, in the interest of national preparedness, following the example set by the engineers of New York, N. Y., who turned out to the number of more than 6,600 for the parade held in that city on May 13.

Among the engineering organizations which will participate in the Chicago demonstration are the American Society of Civil Engineers, Western Society of Engineers, Triangle, a civil engineering fraternity, the Illinois Society of Engineers, the Chicago Engineers' Club, and the Joint Committee on Military Engineerng, an account of the formation of which appeared in "Good Roads" for April 15.

Edmund T. Perkins, Chairman of the Engineering Section of the Chicago Association of Commerce, is chairman of the engineers' section of the volunteer committee having the arrangements in charge, Wharton Clay, Chairman of the Joint Committee on Military Engineering, is vice chairman and marshal, and E. N. Layfield, Secretary of the Western Society of Engineers, is secretary-treasurer.

Contractors Will Be Compelled to Pay License Fee in Maryland

The last session of the Maryland General Assembly passed a law relating to contractors doing a business of more than $5,000 a year in the State of Maryland.

The measure provides that a contracting firm or company which maintains its head office outside the state must pay an annual license fee of $50 for operations in the City of Baltimore and a like fee for each county in which it operates.

Resident firms are required to pay a fee of $10 for operations in Baltimore and $10 additional for each county in which work is done.

Two More Missouri Counties Planning Big Road Bond Issues

Following the example set by St. Louis County, Mo., where a bond issue of $3,000,000 was voted for the construction of roads, two more Missouri counties, Clay and Stoddard, are planning large bond issues for a similar purpose.

Clay County contemplates an issue of $1,250,000 and a proposition to issue $1,000,000 worth of bonds is said to be meeting with considerable favor in Stoddard County.

Jefferson and Wayne Counties have already provided bond issues for road building, as announced in previous issues of "Good Roads." The former voted an issue of $500,000 and the latter one of $200,000.

Fifty Miles of New State Road Designated in Utah County, Utah

The State Road Commission of Utah has designated approximately 50 miles of roads in Utah County as state highways. The mileage is composed of the Mapleton Bench Road, the Benjamin Road, the Lake View and Vineyard Road and the Cedar Valley Road.

Considerable improvement work will be done on these roads during the present season, according to a statement by State Road Engineer Morgan, there being approximately $25,000 of state road funds available for work in Utah County.

The Utah County Commission petitioned the State Road Commission to take over the road from Lehi through Mosida, on the west shore of Utah Lake, but action was postponed, pending an investigation by the state road engineer.

Methods of Financing City Street Paving Discussed by George C. Warren

In an interview on the subject of the streets of Boston, Mass., George C. Warren, President of Warren Bros. Co., Boston, declared recently that the cities which pay for paving with city funds entirely have the poorest streets in the United States, while those which assess all or part of the cost of paving upon abutting properties are provided with the best.

"The real trouble with the streets of Boston," said Mr. Warren, "is due to the lack of sufficient available funds to properly construct and maintain suitable street surfaces, and the reason for the lack of funds is the woeful inadequacy of the legal machinery under which the city is operating."

Mr. Warren went on to say that for many years, and until quite recently, it had been the practice in Boston to accept new streets without requiring that they be adequately paved, with the result that, within a few months, the pavements must be reconstructed, and owing to the fact that after such streets had been accepted, the maintenance must be paid by the city from the general funds, the expense of rconstruction and maintenance became a burden on the city at large.

Under such circumstances, knowing that repairs and renewals will be paid for by the city, owners of property abutting on new streets, use all their influence to have the original improvements made at the lowest possible cost, resulting in a constant heavy drain upon the general funds of the city. Where paving is paid for from the general funds, as in Boston, it is entirely wthin the power of the administration to designate just which streets shall be paved, and while all the taxpayers contribute toward such general funds, only a small proportion receive any direct benefit. This lack of direct benefit creates an added objection of taxpayers to contributing for paving through the general funds.

"There are almost as many methods of financing street paving as there are cities," said Mr. Warren. "They vary from the wildest realms of high finance, such as in New York City, to picayune inadequacy and ultra conservatism, such as in Boston. There is no well paved city in the United States, in my knowledge, which pays for the cost of paving, repaving and maintenance out of the general funds and within the current income from taxes."

Mr. Warren referred to the city of Utica, N. Y., as one of the best paved cities in the United States and mentioned the system in vogue there, which is as follows:

The city pays one-third of the cost of all original pavements and the same proportion of all renewals thereof, and provides for this out of the annual tax of less than an average of $1 per capita of population.

The remaining two-thirds of the cost of original pavements and all renewals is assessed on the abutting frontage, each individual assessed being given the option of paying the whole or any part of the assessment in cash, or deferring payment for six annual instalments with 6 per cent. interest. To cover the deferred assessments the city issues six paving bonds, each for one-sixth of the whole amount of such deferred assessments, and payable in one, two, three, four, five or six years with 5 per cent. interest, the due rates of the bonds and assessments being coincident. The city loses nothing on account of the credit it gives to the taxpayers and the premium the city gets for the bonds and the 1 per cent. extra interest charged the taxpayers, fully pays all clerical or other expenses of the city in the transaction.

The city at large pays for minor repairs required between the time of laying the original pavement and the necessity of reconstruction or resurfacing.

The city of Portland, Ore., according to Mr. Warren, is another example of a well-paved city. In Portland the entire cost of pavements, together with curbing and sidewalks, is assessed against abutting property on the front foot basis. The city extends credit to the property owners, holding liens on the property as security. Upon completion of each contract, the city issues certificates or tax bills against each of the abutting property owners for their pro rata of the cost. The tax bills, which are payable within 30 days, are delivered to the contractor in payment for the work. Each property owner may pay his tax bill to the city treasurer within the 30 days, or he may apply to have the payments extended so that one-tenth, with interest at 6 per cent., will be payable each year for ten years.

Mr. Warren stated that some such constructive plan as those noted will be necessary for Boston before it can hope to become a well-paved city.

Additional Highway Work in Chautauqua County, New York

Contracts have already been awarded for highway work in Chautauqua County, N. Y., aggregating approximately $250,000 and the Board of Supervisors recently approved plans prepared by the State Highway Department for additional work which will cost about $226,000, according to preliminary estimates.

The board also approved plans for paving Foote Avenue in Jamestown, N. Y., at a cost of $40,000 and for improving the road from Belcome Corners to South Dayton at a cost of $52,000. The county's share of this expense will be $66,690 and the board appropriated that sum at the time the plans were approved.

Police Court Prisoners Worked on Roads in Chatham County, Georgia

According to a report by the National Committee on Prisons, police court prisoners are being employed on road work in Chatham County, Ga., with considerable success. Offenders of this class are usually sent to jail for short terms for minor infractions and are not worked with state or county prisoners.

It has been demonstrated in the case of state and county prisoners that fully 25 per cent. are ill in one way or another when first sent to jail. Outdoor work is said to be responsible for a reduction in illness to seven-tenths of 1 per cent.

Bids Received for 82 Miles of Highway Construction in Ohio

The Ohio State Highway Department recently received bids for the construction of 82 miles of state highway. Competition was keen, and the total amount of the low bids was $1,239,769.25, which is considerably less than the estimates.

The work is located in 24 counties, and most of the contracts include bridge and culvert work. This is the third important letting of the present year in Ohio.

Details concerning the various contracts and the names of the lowest bidders are given below:

Athens County, Logan-Athens Road—Brick, 1.5 mile, Wilson & Beckler, Lancaster, $29,606.17.

Auglaize County, Kenton-Wapakoneta Road—Water bound macadam, 1 mile, Lowell A. Harvey, Lakewood, $9,982. Celina-Kossuth Road—Water bound macadam, 1.01 mile, Putnam & Shingledecker, Van Wert, $10,395.

Columbiana County, Salem-Alliance Road—Brick (monolithic), 4.12 miles, Jones Construction Co., Mt. Vernon, $81,500.

Defiance County, Hicksville-Defiance Road—Reinforced concrete, 3.94 miles, Clemmer-Johnson Co., Hicksville, $53,617.52.

Fulton County, Toledo-Angola Road—Water bound macadam, 2.32 miles, Jonathan Nofziger, Wauseon, $20,990. Wauseon- Napoleon Road, 1.53 mile, R. C. Roach, Waterville, bituminous macadam "A," $17,770; bituminous macadam "B," $16,625; water bound macadam, $13,770.

Guernsey County, McConnellsville-Cambridge Road, 1.08 mile, Oliver G. Schaeffer, Caldwell, $6,394. National Road—Lignin liquor and oil surface treated macadam, 7.48 miles, W. H. Young, Columbus, $105,541.13.

Hancock County, Lima-Sandusky Road, 6.48 miles, Barnett & Christian, Rockford, reinforced concrete, $94,942.73; Heystek-Baker Construction Co., Kalamazoo, Mich., brick (monolithic), $113,961.94. Lima-Sandusky Road, 3.48 miles, E. A. Freshwater & Sons, Chester, W. Va., reinforced concrete, $51,888; Wm. E. Dorsey, Findlay, brick (monolithic), $61,687. Lima-Sandusky Road, 2.34 miles, Wm. E. Dorsey, Findlay, brick (semi-monolithic), $43,182; E. A. Freshwater & Sons, Chester, W. Va., reinforced concrete, $32,989.

Huron County, Barberton-Greenwich Road—Brick (monolithic), 1.26 mile, F. L. Rice & Sons, Shelby, $23,175.75. Bellevue-Norwalk Road—Brick and concrete, 0.90 mile, G. E. Scott, Norwalk, $16,948.

Knox County, Columbus-Wooster Road—Brick (monolithic), 0.98 mile, Lee, Griggs & Anderson, Millersburg, $17,254.

Lake County, Painesville-Warren Road—Reinforced concrete, 0.71 mile, Farrell Engineering & Construction Co., Cleveland, $14,646.

Licking County, Newark-Lancaster Road—Bituminous macadam, 2.12 miles, Vogelmeier Bros., Newark, $23,489.89.

Madison County, Washington-London Road—Water bound macadam, 0.81 mile, Theodore Vogelsburg, London, $10,497.95.

Miami County, Piqua-Sidney Road, 5.78 miles, J. A. Westrick, Holgate, brick and reinforced concrete, $89,899.90; reinforced concrete, $77,536.75; reinforced concrete and bituminous macadam, $70,082.10; brick and bituminous macadam, $72,289.87.

Muskingum County, Zanesville-Dresden Road—Bituminous macadam, 1.47 mile, Adams Bros. Constructing Co., Zanesville, $18,671.75.

Richland County, Mansfield-Mt. Vernon Road—Bituminous macadam, 1.5 mile, C. H. Au & Son, Mansfield, $25,848. Mansfield-Ashland Road—Brick (monolithic), 1.65 mile, F. L. Rice & Sons, Shelby, $29,400.35. Bellville-Lexington Road—Bituminous macadam, 1.50 mile, Lee, Griggs & Anderson, Millersburg, $17,719.95.

Ross County, Cincinnati-Chillicothe Road—Concrete and water bound macadam, 1.85 mile, McCoy & Kellar, Jackson, $17,400.

Sandusky County, Fremont-Bowling Green Road—Reinforced concrete, 6.01 miles, A. G. Tripper, Peru, Ind., $84,758.

Summit County, Akron-Canton Road—Brick, 2.06 miles, McGarry & Stowe, Akron, $44,862.54.

Trumbull County, Chagrin Falls-Greenville Road—Surface-treated macadam, 3.09 miles, Jordan & Walters, West Austintown, $29,915.10.

Union County, Marysville-Marion Road—Brick, 0.34 mile, W. H. Ringwald & Sons Co., Chillicothe, $14,871.10.

Washington County, Marietta-McConnellsville Road, 1.09 mile, McElfresh, Danford & Glover, Caldwell, bituminous macadam and brick, tar, $24,396; asphalt, $24,751.65.

Wayne County, Wooster-Canal Dover Road, 1.98 mile, McGarry & Stowe, Akron, brick, $28,658.56; brick (monolithic), $24,857.10.

William County, Bryan-West Unity and Bryan-Wauseon Roads, 4.69 miles, C. M. Acker and J. A. Elder, Bryan, bituminous macadam, tar, $48,200; bituminous macadam, asphalt, $50,900; water bound macadam, $41,000. Bryan-Edgerton Road, 6.75 miles, Kelley Construction Co., Bryan, bituminous macadam, tar, $76,116; bituminous macadam, asphalt, $80,674; water bound macadam, $65,614.

Wyandot County, Forest-Upper Sandusky Road—Brick, 1.02 mile, Modern Construction Co., Fremont, $20,800.

Roads and Bridges Damaged by Storm in Southwestern Maine

A recent severe storm, accompanied by a rainfall of 4.90 ins., worked serious damage to roads and bridges in Southwestern Maine, particularly in Cumberland and York Counties. Complete estimates of the damage are not yet available, but will run into the hundreds of thousands, it is said.

Entire sections of the highway between Portland, Me., and Portsmouth, N. H., were completely washed out and other sections were undermined or otherwise rendered impassable. According to reports, it is due to the system of patrol maintenance instituted not long ago, in Maine, that conditions are not even worse. The work of making the roads passable is proceeding as rapidly as possible under the direction of the State Highway Department.

COMING MEETINGS

May 31-June 2—New York State Conference of Mayors.—Annual conference, Syracuse, N. Y. Secretary, William P. Capes, New York, N. Y.

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 13-14—Intermountain Good Roads Association.—Annual convention, Ogden, Utah. Secretary, O. J. Stilwell, Ogden, Utah.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

North Carolina Good Roads Association

The annual convention of the North Carolina Good Roads Association will be held at Wrightsville Beach, Wilmington, N. C., from June 21 to June 23, as noted above. All organizations in any way affiliated with the good roads movement in North Carolina are co-operating to make this the most successful meeting of its kind ever held in the state.

Although the program has not yet been completed, it is known that the following subjects will be dealt with: "Road Maintenance," "Sign Boards," "Federal Aid," "Automobile Tax," "Work of State Prisoners on Public Roads," "County Prisoners," "North Carolina's System of Highways," and the "Asheville-Murphy Scenic Highway."

Among the speakers who have been invited to discuss the various subjects are Lieut. Governor Daughtridge of North Carolina, State Highway Engineer W. S. Fallis, W. S. Shirley, State Road Engineer of Maryland; Charles Henry Davis, President, National Highways Association; O. L. Evans, President, Virginia Road Builders' Association; Dr. Joseph Hyde Pratt, State Geologist and Secretary, North Carolina Good Roads Association; A. G. Batchelder, Chairman Executive Committee, American Automobile Association, and Mrs. Thomas W. Lingle, President, North Carolina Federation of Women's Clubs.

A number of entertainments have been arranged for the delegates, among them being a vaudeville show by the Wilmington Rotary Club, yacht races, athletic games and fishing trips. There will also be an automobile trip over the roads of New Hanover County, N. C.

The annual meeting of the Yosemite-to-the-Sea Good Roads Association will be held at Pacific Grove, Cal., July 22. It is expected that the speakers will include Governor Johnson of California and members of the California Highway Commission. L. A. Nares, Fresno, Cal., is President of the association, and R. H. McKaig, Pacific Grove, is Secretary.

MEETINGS

Arizona Good Roads Association

The annual convention of the Arizona Good Roads Association, with which was held the meeting of the Arizona Association of Highway Engineers, was held on Monday and Tuesday, May 15 and 16, at Phoenix, Ariz., in the rooms of the Phoenix Chamber of Commerce.

The program included addresses by Mayor Corpstein of Phoenix, Governor Hunt of Arizona, Austin B. Fletcher, State Highway Engineer of California, and James A. French, State Engineer of New Mexico, and the following papers: "Federal Aid," Lamar Cobb, State Engineer; "Grading Equipment and Grading Cost," J. C. Ryan, Cochise County Engineer; "Bridge Building in Apache County," J. S. Barlow, Apache County Engineer; "Forest Service Roads in Arizona," Paul G. Redington, District Forester, Albuquerque, N. Mex.; "Texas Roads," D. E. Colp, Secretary, Texas Good Roads Association.

PERSONAL NOTES

O. D. Chrisman has been appointed City Engineer of Springfield, Mo.

E. S. Hathaway has been appointed City Engineer of Missoula, Mont.

Hugh Bennett has been elected Commissioner of Public Works of Ada, Okla.

Charles Wilson has been appointed a member of the engineering staff of Youngstown, O.

Frank Sheets has been appointed Assistant Maintenance Engineer of the Illinois State Highway Department.

William C. Campbell has resigned as Superintendent of Public Works of Columbus, Ga., to engage in the contracting business at Charlotte, N. C.

C. E. Painter resigned as Assistant City Engineer of Newton, Kan., to take a position with Black & Veach, consulting engineers, Kansas City, Mo.

George D. Mackie, City Engineer of Moose Jaw, Sask., has been appointed a member of the Royal Commission to investigate the work of the Provincial Highways Department.

Edward R. Stapley, who has been instructor in civil engineering at Cornell University, Ithaca, N. Y., has resigned to become Resident Engineer for Wilson, N. C., where improvements, costing about $500,000, are under way.

Schley Gordy has been promoted to the position of Superintendent of Public Works of Columbus, Ga., filling the vacancy caused by the resignation of William C. Campbell, noted elsewhere in this column. Mr. Gordy was Mr. Campbell's assistant for several years.

NEWS OF THE TRADE

The Troy Wagon Works Co., Troy, Ohio, has issued a folder regarding Troy trailers for motor trucks. It gives a list of the various makes of motor trucks with which Troy trailers are now being used.

The Standard Brick Co., Crawfordsville, Ind., has been licensed to manufacture Dunn wire-cut lug paving brick. This makes 30 companies, operating 48 plants, under Dunn licenses. The Standard Brick Co. has a daily capacity of 25,000 brick and is increasing its plant to a capacity of 35,000.

The following officers of the Cement Products Exhibition Co., Chicago, Ill., were elected at a meeting held May 23: President, B. F. Affleck, Universal Portland Cement Co.; Vice President, A. Y. Gowen, Lehigh Portland Cement Co.; Secretary, Blaine S. Smith, Universal Portland Cement Co.; Treasurer, J. U. C. McDaniel, Chicago Portland Cement Co. The Board of Directors consists of the officers and these members: W. E. Cobean, Wolverine Portland Cement Co.; William Dickenson, Marquette Cement Manufacturing Co.; D. McCool, Newaygo Portland Cement Co.; Robert F. Hall, Portland Cement Association, and Arthur Cameron, Municipal Engineering & Contracting Co.

NEWS NOTES

Polk County, Fla., has recently awarded a contract for road work amounting to $1,434,000. The H. S. Jaudon Engineering Co., Savannah, Ga., was the fortunate bidder.

Governor Whitman of New York has signed two bills passed by the last Legislature, prohibiting the construction of state or county highways within the limits of cities of the second or third class and villages.

The Pittsburgh, Pa., Council is considering bond issues amounting to $520,000. One of $124,000 is for the reconstruction of the Greenfield Avenue Bridge and one of $396,000 is for the widening of East Ohio Street.

Motor Vehicle License Fees in New York State must be divided equally between the counties where they are collected and the state at large, according to a bill recently signed by Governor Whitman. It is estimated that the receipts for the current year will aggregate more than $2,500,000. Under the law Greater New York's share goes into the general fund of the city, but in all other counties, the county's share must be devoted to road work.

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FEDERAL MONEY FOR LOCAL ROADS.

A fifty thousand dollar federal building, half unoccupied and serving a community of fifty or sixty houses nestled in the bend of an inland creek made "navigable" with money from the national treasury, can easily be visualized by any American citizen conversant with present conditions. If the federal aid bill recently passed by the Senate finally becomes a law—as it may before this reaches the reader—the picture can be enhanced by the addition of boulevards radiating out from the federal building into the surrounding country.

For some time it has been realized that federal aid in some form or another would eventually become an accomplished fact. The expenditure of funds from the national treasury for the improvement of roads has always appealed to the patriotic instincts of some statesmen. The idea has found favor in certain sections of the country, and sentiment for it has grown rapidly under the accelerating influences of various interests which could see in it benefit to themselves. On the other hand, it has always been opposed by many of the best informed highway authorities and students of public affairs. The arguments both for and against federal aid have frequently been taken up in these columns and will not be gone into here. There are certain features of the present federal aid measure, however, which can well be brought to the attention of our readers.

Probably the most objectionable feature of the bill is the method by which the federal funds are to be apportioned. If there is one thing which apparently was left entirely out of consideration in the formulation of this scheme it was the distribution of the funds in such a way as to return the money to the several states in the same proportions in which they contribute to the federal revenues. During the discussion of the measure in the Senate, Senator Lippitt, of Rhode Island, an opponent of the bill, introduced a table showing the amount each state would receive out of every $25,000,000 appropriated, as proposed in the Shackleford Bill—which differed very little, in the proposed method of apportionment, from the bill finally passed. The table also showed the portion paid by each state of every $25,000,000 collected through the corporation and income taxes. According to the table, twelve states —California, Connecticut, Delaware, Illinois, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania and Rhode Island—pay more than they would receive, while the balance of the states would receive sums in excess—many greatly in excess—of the amounts they pay. It was pointed out by Mr. Lippitt that of the states that pay more than they would receive, Massachusetts, New York and Pennsylvania alone pay more than 50 per cent. of the entire amount collected. They would receive only between 11 and 12 per cent. of each $25,000,000 distributed by the government.

The problem of distributing money from the federal treasury for aid in the building of roads is very complex, and any solution of it should take into account many more factors than the three—area, population and mileage—which govern in the present bill. It is not difficult, however, in view of the information given by the table, to understand why the proposed plan of distribution received support in the Senate.

Another feature of the bill, which is open to objection, is the power it gives to the Department of Agriculture. This division of the government now can not be regarded as competent for this work, nor is it likely to be made competent under the provisions of the bill. The measure vests in the Secretary of Agriculture the power to approve the selections by local authorities of the road to be improved; to approve plans, specifications, and estimates for work to be done; to withhold money apportioned to any project, unless the roads for which it is to pay have been properly maintained, and to "make rules and regulations for carrying out the provisions" of the act. It is reasonable, of course, that if federal funds are to be used, the federal government should have some measure of control over the work done with those funds. It is not, however, advisable to place such control under a department or bureau which is not properly organized to exercise it. The bill should have made some provision for a federal organization of competent, experienced men, placed well above the influence of partisan politics.

While there are many other details of the bill which could, and perhaps should, be criticised, space is not available for that purpose. That the bill is political in its nature and that it can properly be classed as "pork barrel" legislation is evident from a merely superficial examination of the measure itself, or from the most cursory reading of parts of the discussion upon it. It can perhaps be summed up best by the words of Senator Lippitt, who, during the discussion previously referred to, said: "It seems to me that under the showing of that table this bill is a 'pork barrel' proposition that makes the most extravagant river and harbor bill look like an infant industry."

MILEAGE AND COST

Two points that can hardly be emphasized too much were made by H. W. Boetzkes, Assistant State Highway Engineer of Washington, in a paper read at the Road Builders' Institute held at the University of Washington last month and printed in abstract form on another page of this issue. The first point is that expenditures made for grading and for permanent drainage structures are true economy of the highest type. The second is that the service a road system will render to the public depends upon its mileage.

It is often true economy to spend the greater part of the funds provided for a particular improvement in grading and drainage work, laying an inexpensive surface that will serve until a better one can be afforded. No surface is "permanent" within the strict meaning of the word, nor is any drainage structure, for that matter. But the degree of permanency of well built drainage structures is far greater than that of the ordinarily durable surfacings. Grading work, of course, is more permanent than anything else that is done in the building of roads and streets. Money spent in grading and building permanent drainage structures is, therefore, invested in something that will last for many years and which may properly be paid for, in part at least, by the future generations that will be benefited. In other words, it is an economical use of road building funds.

The second point made by Mr. Boetzkes perhaps merits even more emphasis than the first, for its truth seems to be less commonly recognized—at least in practice. There apparently exists a strong tendency towards what may be called intensive road improvement, although there is no lack of desire or advocacy of the betterment of large mileages. While the particular problem in any community must be solved separately, it is safe to lay down the general rule that money should not be used for expensive work on a few roads or sections of road, but should be used to improve the greatest possible mileage in the best way possible with the funds available. An expenditure for road work should be considered as carefully as the expenditure for the enlargement or improvement of plant is considered in privately conducted business enterprises, taking into account essentially the same governing factors.

We believe that Mr. Boetzkes did well to make these points at the Road Builders' Institute at the University of Washington. We believe he did well to emphasize them as strongly as he did, and we are glad to add what we can here in the way of further emphasis.

THE EXPORTATION OF ROAD MACHINERY AFTER THE EUROPEAN WAR

In the general work of reconstruction with which Europeans must busy themselves when the present war is over, the building of roads will be an important part. Great amounts of road machinery of all kinds will be needed and American manufacturers will do well to make plans for securing a share in the business.

Attention is directed to this matter by the legislation proposed by the Federal Trade Commission, note of which was made in the issue of May 20. The proposed measure is an amendment to the Sherman Anti-Trust Law and supplementary laws and is designed to legalize combinations of manufacturers for the extension of export trade by any means "which do not operate to the prejudice of the American public and are lawful in the countries where the trade is to be carried on." In support of the measure it is pointed out that in nearly all leading countries business concerns are in a better position to combine to secure export trade, being not only less restricted by law but even aided in various ways by their governments.

Although at this writing the end of the war is not in sight, it is none too early to begin preparations for the conditions that will come with peace. The war may end as suddenly as it began, and keen international competition in trade is sure to follow the cessation of hostilities. It is to be hoped that American manufacturers will have the cooperation of the government in carrying out whatever plans they may make between now and the end of the war. In the meantime they can do what is possible to bring about the passage of the amending legislation suggested by the Federal Trade Commission.

NATURAL CEMENT FOR ROAD AND STREET FOUNDATIONS

Since the function of the engineer is largely, as some one has put it, "doing with one dollar what any —— fool can do with two," highway engineers will be interested in the attempt being made by a natural cement manufacturer to restore that material to the place it once held in engineering work. The matter is covered briefly on another page of this issue.

The claim made by the manufacturer is, in substance, that natural cement is as good as Portland cement for the concrete in road and street foundations and that it is more economical than Portland. Examples of past work which are cited bear out the contention that strength and durability were secured in former work, and it is reasonable to suppose that even better results could be secured now that manufacturing methods have been improved and the use of the material is better understood. The relative cost is a matter of market prices, proportions of the mix, and local conditions

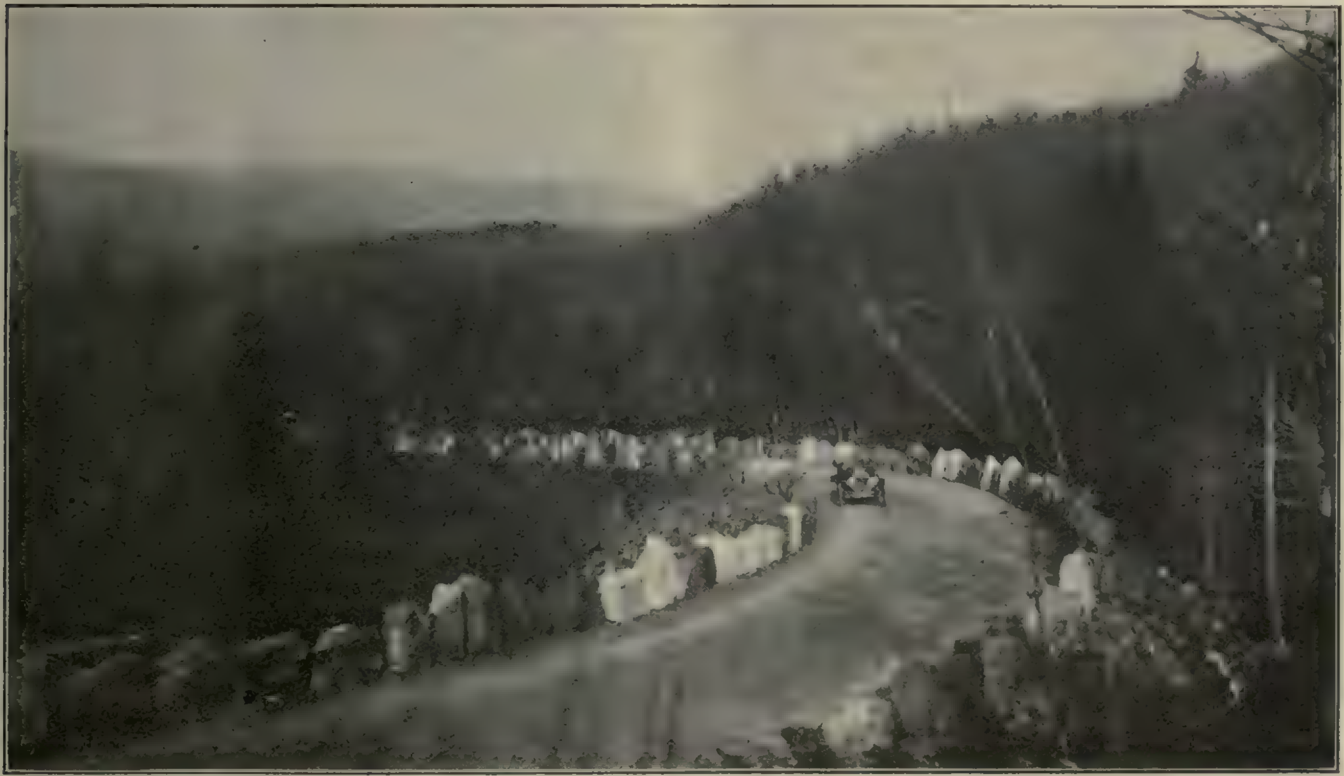
The question is one upon which discussion will be profitable, especially if it brings forth the results of experience with natural cement in roadway and pavement foundations. Our readers' views will be welcomed.

A Bituminous Macadam Road at Bear Mountain in Palisades Interstate Park

By **BURTON H. ALLBEE**

There has recently been constructed a section of road crossing Bear Mountain in Palisades Interstate Park. The road, which is about eleven miles long, is part of the Hendrick Hudson Drive, which eventually will extend through the park from Fort Lee, N. J., to Kingston, N. Y. The section just constructed connects with the main road to Tuxedo, and is expected to carry heavy automobile traffic.

Bear Mountain, one of the prominent peaks in the line of mountains and hills along the west side of the Hudson, is about forty-one miles north of New York. It is about 1,300 ft. high and rises abruptly from the river. Directly across the river is "Anthony's Nose," another peak, and just below is a narrow part of the Hudson across which, in 1777, a chain was stretched to prevent the passage of British vessels further up the river.



LOOKING DOWN BEAR MOUNTAIN, OR SOUTHFIELD ROAD FROM STATION 30—SHOWING A HEAVY FILL AND PROTECTING WALLS OF IRREGULAR BOWLDERS.

Palisades Interstate Park is a long, narrow strip of land along the western shore of the Hudson, comprising about 20,000 acres and varying in width. At Bear Mountain the park includes all of Harriman Park, formerly owned by the late Edward H. Harriman, whose widow presented it to the Palisades Interstate Park Commission. A description of the road from the Englewood dock up the Palisades to the end of Palisade Ave., Englewood, which forms the southern approach to the Hendrick Hudson Drive, was printed in "Good Roads" some time ago. ["Construction Features of a Roadway up the Palisades of the Hudson." By Burton H. Allbee, "Good Roads," Oct. 3, 1914, p. 140.—Ed.]

The Bear Mountain, or Southfield, Road is paved to a width of 16 ft. with bituminous macadam on a telford foundation with a 5-ft. shoulder on either side. The maximum grade is 5 per cent., except on two short sections, where it is 7 per cent. The road winds around the mountain, steadily ascending and sometimes crossing ravines of considerable depth. Much of it is built through rock and the cuts and fills are heavy. The construction required 70,000 cu. yds. of earth excavation, 60,000 cu. yds. of rock excavation, 140,000 cu. yds. of embankment, 2,800 cu. yds. of masonry, 2,000 cu. yds. of masonry culverts, and 50 tons of cast iron pipe culverts.

The foundation course consists of telford, 10 ins. deep. In the construction of the wearing surface the large stone was laid in two courses. The first consisted of 2 ins. of 1½-in. stone bound with 1 gal. per sq. yd. of Standard Oil Binder "B". The second course was of the same thickness and same size stone as the first and was treated with the same amount of binder. On this was spread a ½-in. course of ½-in. stone which was rolled and treated with ¾ gal. of binder per sq. yd. The finishing course consisted of another ½-in. course of ½-in. stone. A 12-ton roller was used for compacting all of the courses.

The work was done by the Palisades Interstate Park Commission by day labor, a force of 600 men being employed for a period of about 14 months. The equipment used consisted of 8 steam boilers which operated 16 steam drills and 2 crushing plants; 4 12-ton rollers, 1 concrete mixer, and 40 two-horse wagons. The work was done under the supervision of W. A. Welch, Chief Engineer of the commission, and was superintended by the commission's engineering force.

The personnel of the present Commission is as follows: New York Commission—George W. Perkins, President; Franklin W. Hopkins, Vice President; J. Du Pratt White, Secretary; Edward L. Partridge, Treasurer; Richard V. Lindabury, William H. Porter, W. Averill Harriman, Frederick C. Sutro, Charles W. Baker and John J. Voorhees.

New Jersey Commission—Richard V. Lindabury, Presi-

GRADING A PORTION OF THE BEAR MOUNTAIN ROAD

dent; Edward L. Partridge, Vice President; J. Du Pratt White, Secretary; Frederick C. Sutro, Treasurer; George W. Perkins, Charles W. Baker, Mornay Williams, John J. Voorhees, William H. Porter and W. Averill Harriman. Elbert W. King is Assistant Secretary and is in charge at the Commission's offices at 61 Broadway, New York.

National Electric Light Association Committee's Report on Roads

That the effect of the condition of pavements upon the mileage obtainable from one charge of a storage battery is of sufficient importance to warrant the Electric Vehicle Association in making a strong effort to obtain better paving and the betterment of methods of street cleaning, was asserted in the report of the Committee on Traffic and Good Roads submitted to the Electric Vehicle Section at the National Electric Light Association's thirty-ninth convention at Chicago on May 22-26.

"A good road," according to the report, "is considered one of the most valuable assets of a community. It encourages agriculture, trade and enterprise. It increases real estate values and opens up land hitherto inaccessible for development." Continuing, the report points out that American roads are comparatively young and that their improvement has not kept pace with the improvement of the soil. It is also stated that upon the good condition of the roads depend the following.

"The ability of farmers to deliver their products to the consumer or to the railroad.

"The food supply of the cities.

STONE CRUSHING PLANT OPERATED ON THE BEAR MOUNTAIN ROAD WORK.

"The ability of physicians to reach their patients and, in many cases, in time to save life.

"The ability of fire apparatus to quickly reach their destinations in rural sections in time to save property and possibly life.

"The ability of the state to quickly transport military forces and their equipment and supplies in time of riot, insurrection or war."

Under the heading, "What constitutes a good road?" it is stated that a good road "is easily defined—it must be hard and smooth, well drained, and wide enough to carry all traffic which will pass over it in both directions." It is pointed out, however, that to build a road to meet these four simple requirements is an engineering problem.

Among the recommendations in the report are that bridges be strengthened and rebuilt to carry the increased loads and widened to the full width of the highway; that bridges and their approaches be protected by walls or strong guard rails; that railroad crossings concealed by trees or buildings be adequately marked by warning signs illuminated and legible at night, and that the final abolition of all grade crossings should be the object of railroads and the community; that sharp turns and excessive grades should be eliminated where possible; and that toll roads should be purchased by the states.

RETAINING WALL AND ROCK CUT ON SIDEHILL WORK

A large portion of the report is taken up by a description of the experimental work done in Philadelphia in the construction and observation of the Byberry and Bensalem service test road and the Oxford Pike concrete service test road. Reference is also made to experiments being conducted at the Massachusetts Institute of Technology to determine the amount of power used by motor vehicles on different kinds of pavements, on pavements in good condition and in poor condition, and on pavements when clean and when covered with ice and snow.

The Contractor's Bond

By JOHN M. WILSON[†]

With the introduction of our modern system of road building, under which extensive road construction at greatly increased cost over the older systems has become quite general, the matter of guaranteeing the work by good and sufficient bonds has become a subject of great importance, and the statutes of the states generally require all contractors to furnish such bonds at the time of entering into the contract. The State of Washington has many such statutory provisions; some requiring any public contracting body to require a bond, and others providing that at the time the contracts for public work are let a bond with certain definite conditions shall be entered into.

Many interesting questions are presented to the courts regarding these bonds. The requisites and validity, the persons secured, the extent of liability, the effect of change or alterations of contract upon the liability of the sureties on the bond, the effect of failure to give notice of default in the contract, the acts which amount to a discharge of the sureties, and the rights of creditors of contractors as against the sureties, are among the more important questions considered by the courts. All of them are of vital interest to parties and communities engaged in the construction of highways, streets and public utilities generally.

Necessity for the Bond

As has been said, these bonds are now generally required by statute. Section 1159, Rem. & Bal. Code, as amended by chapter 28, Laws of 1915, provides:

> Whenever any board, council, commission, trustees or body acting for the state or any county or municipality or any public body shall contract with any person or corporation to do any work for the state, county or municipality, or other public body, city, town or district, such board, council, commission, trustees or body shall require the person or persons with whom such contract is made to make, execute and deliver to such board, council, commission, trustees or body a good and sufficient bond, with two or more sureties, or with a surety company as surety, conditioned that such person or persons shall faithfully perform all the provisions of such contract and pay all laborers, mechanics and sub-contractors and material men, and all persons who shall supply such person or persons, or sub-contractors, with provisions and supplies for the carrying on of such work, which bond shall be filed with the county auditor of the county where such work is performed or improvement made, except in cases of cities and towns, in which cases such bond shall be filed with the clerk or comptroller thereof, and any person or persons performing such services or furnishing material to any sub-contractor shall have the same right under the provisions of such bond as if such work, services or material was furnished to the original contractor * * *.

By various statutes regulating the construction of roads, streets and highways, it is provided that before any contract shall be let the contractor shall furnish a bond containing the above conditions.

A failure on the part of a municipality to exact such a bond from a contractor may render the municipality liable for the cost of the material furnished in connection with the construction work performed under the contract (Fransiola v. Thompson, 59 Wash. 259). In fact, it has been held that where a city failed to require a contractor to enter into a bond for the performance of public work and the payment of debts incurred, as required by statute, the city's liability therefore is absolute (Gate City Lumber Co. v. Montesano, 60 Wash. 586). This requirement of the statute is just and reasonable and is manifestly for the protection of those who have to pay for the improvements because it is well known that it is possible for work to be apparently done in the manner required by the contract and yet, in fact, great frauds might be perpetrated by contractors and if no security had been taken the loss would fall upon those who had to pay for the improvement because if the improvement were worthless the property owner would again be liable to assessment for additional improvement.

Requisites and Validity

The courts have adopted a somewhat liberal rule in holding bonds to be valid and binding, notwithstanding they may contain some defects as to form. Thus it has been held that the principal and sureties upon a contractor's statutory bond given to a city to protect laborers and material men upon public work, cannot take advantage of a mistake whereby the bond was to the city instead of the state as required by statute; also that it is immaterial whether a contract between the contractor and a public corporation was executed before or after the execution of the bond. The fact that at the date a building contract was executed the contractor had men upon the premises engaged in work preparatory to the erection of the building, does not show a want of consideration for the bond when there is no evidence showing that the contractor was in possession of the premises by direction or request of the owner, or that the giving of the bond was not an inducement to the signing of the contract on the part of the owner. It is the intention of the parties which governs, and where it is shown on the part of all the parties that they intended to provide the security required by law in the interest of those who might thereafter by virtue of the instrument become entitled to protection, the courts look more to the substance than to the form in determining whether or not such instrument shall have force.

Persons Secured and Extent of Liability

A surety bond, in the language of the statute, is generally construed as a protection to laborers and material men furnishing labor and material which enter into the construction under the contract. It has been held that while the contract did not expressly provide that the contractors should pay the bills incurred in the prosecution of the work, yet that an agreement to furnish materials includes an agreement to pay for them. (Crowley v. United States Fid. & Guar. Co., 29 Wash. 268).

It has been recently held by the Supreme Court of Washington, however, that a building contractor's surety bond to a private owner, conditioned to furnish materials and pay all liens, claims and other sums of money and to be void in case the principal shall perform the contract and indemnify and save harmless the owner, is for the owner's protection only and that he cannot maintain an action thereon against the surety for the benefit of creditors of the contractor who have no liens against the property or claims by which the owner could be damaged, as there was no privity between the surety and such creditors. (Rust v. United States Fid. & Guar. Co., 87 Wash. 93).

The general rule is that a surety company on a private bond is not liable to the material men as no privity exists between them, i. e., the bond was not given for their benefit.

The rule, however, is different in cases involving public bonds. They are presumptively given for the benefit of creditors to take the place of a lien which does not lie against the municipality. Hence it has been held that where a county takes a bond from a contractor for the construction of a county road for the benefit of laborers and material men a right of action of a material man is enforcible against the bondsman and his sureties and not against the county. (Baum v. Whatcom County, 19 Wash. 621).

Where a surety on a contractor's bond takes an assignment of the contract and undertakes to complete the work himself, his liability is not restricted to that imposed by the

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bond, but he becomes liable for all losses under the contract.

The liability of sureties under a bond is sometimes released by changes or alterations in the contract made without consent or knowledge of the surety. The rule is that when a bond is executed to secure the cost of the performance of the particular work the bondsman cannot be held for the cost of performing an entirely different work. Slight or immaterial changes in a contract of this kind, of course, do not affect the liability of the bondsman, but a radical change such as a substitution of an entirely different thing for the thing contracted for will work the result. When, however, the contract permits the making of alterations the surety is not released. In such a case it is held that the surety must be regarded as having consented in advance to alterations in the contract and cannot escape liability on the ground of alterations having been made without the express consent of the surety.

Cases sometimes arise wherein the contract between the state or municipality and other parties is *ultra vires,* or invalid, for other reasons, giving rise to the question of the effect of such conditions upon the liability of the sureties on the contractor's bond. It is the universal rule that in such cases the invalidity of the major contract in no way affects the secondary contract between the contractors, material men and laborers. The plea of *ultra vires,* or the invalidity of the contract in pursuance to which the bond was given, cannot be set up by the contractor or the surety as a defense in an action on the bond by such material men or laborers. (Kansas City, etc., Brick Company v. National Surety Company, 127 Fed. 620; Bell v. Kirkland, 102 Minn. 213; St. Louis v. Davidson, 102 Mo. 149.)

In many cases a time limit is placed upon the completion of the work; that is to say, a limit is fixed within which time the contractor must complete the work. When no provision is contained in the contract, it is generally held that the work must be done within a reasonable time. Some statutes require that the time for commencing and completing the work shall be fixed. In contracts providing a time limit it is frequently provided that a penalty in the nature of liquidated damages shall be paid by the contractor for each day's delay, and the question may arise as to who is entitled to the benefits of such recovery. In some jurisdictions (Mo.) it is held that such a provision is intended for the benefit of the property owners and that they are entitled to have a proportionate amount or share of the penalty deducted from their assessment. The majority rule, however, is that such provisions are not intended for the benefit of property owners but are intended to secure the speedy and efficient construction of the work. This later rule seems the more tenable since it is generally conceded that the municipality may or may not enforce such penalty in its discretion. (Case Farm Company v. Detroit, 124 Mich. 433; Gullick v. Conley, 24 Ind. 134.)

Extent of Guarantee

It sometimes occurs that bonds are given guaranteeing the work for a certain period of years. The courts of different jurisdictions differ as to the time which may be covered by this character of guarantee. In some jurisdictions it is held that where the whole or any part of the work is assessable to the abutting property owners, it is not lawful to require a guarantee for a period longer than the reasonable life of the work without repair. In other words, if the guarantee carries with it an obligation of maintenance, an assessment on the abutters is illegal because it charges them with cost of maintenance, which maintenance the law provides shall be paid for out of the general funds of the municipality. One or two cases illustrating this doctrine may be of interest.

In "Philadelphia vs. Pemberton, 208 Pa. 214, 1904. The contract provided that the contractor 'keep the street in good order and repair at the finished grade for at least five years after the same shall have been paved and thrown open for public use.' * * * 'The kind of pavement to be constructed and the character of the work to be done are matters within the discretion of the municipal authorities, and it is competent for them to secure the proper performance of the contract by a guarantee of permanency of the work, if in so doing they do not impose upon the property owner more than the cost of the original pavement, constructed in strict compliance with the specifications. * * * Unless the time for which repairs are to be made is so unreasonable as to indicate an intention to impose the cost of maintenance upon the abutting owner, the provision for repairs will be regarded as a guarantee of compliance with the contract for paving.'"

In "The Case of People ex. rel. Hall vs. Maher, 9 New York, Supplement 94, Supreme Court, 1899: 'The Charter of the City of Albany provided that the repairing of streets should be charged upon the city. An ordinance to pave Delaware Avenue directed that the contract should require the contractor to agree to keep the pavement in repair for seven years without expense to the city, or abutting property owners. It was held that the contract was void since it threw upon the property owners the expense of keeping the pavement in repair, whereas such expense was chargeable only upon the city. * * * A further argument is made, viz., that since 1883 every contract of paving has required the contractor to keep the pavement in repair for a year. *But this may reasonably be considered a time within which to test the pavement. Defects in the construction may not appear immediately and this time of one year may be proper, in order that any such defects may become apparent.* * * * It is not subject to the objection made by the relator, being in substance only a security for the thorough completion of the work, and unobjectionable, so far as we can now see. * * * It is the duty of the city to make the repairs. But by this contract they make the property owners liable to pay not only for the laying of the pavement, but for making repairs for seven years. Every contractor was obliged to agree to these terms. The city, therefore, compels the property owners to pay the contract price, not only for laying the pavements, but for the seven-year repairs. This it has no right to do, and it cannot make such a proceeding valid by testimony that the contractor did not include a charge for repairs in his bid. If, as the contractor claims, no repairs will be needed, then there was no need for such a clause. Evidently, the city thought repairs might be needed, and arranged that the property owners should pay therefor in advance. They have a right to insist that the specifications for which proposals are to be made, and the contract entered into thereon, shall be limited to that work which they are bound to pay, viz., the construction of the proposed work, as distinguished from subsequent repairs. The decision of the board is reversed, and the contract adjudged illegal. All concur.'"

Failure to Give Notice of Default

The contractor's bond usually provides for notice to be given by the obligee to the surety of any default on the part of the principal in respect to any of the terms or conditions of the contract. The Supreme Court of Washington has repeatedly held that a failure to give notice of default in the class of bonds here being considered is only a defense insofar as the surety has been prejudiced or damaged by such failure. It is not necessarily fatal to the right of the obligee to recover on the bond that notice of the principal's failure to comply with the terms of the contract was not given at the time the bond prescribes. While it is true that the requirements of notice are for the surety's benefit, and it may insist on a strict compliance with the terms of the bond in that respect whenever failure to give such notice might result in a loss to it, yet when the notice serves its purpose as well when given after the prescribed time as it does before, it is inequitable and a manifest abuse of the purpose of this provision of the bond to hold that the mere technical variance shall relieve the obligor entirely. (Heffernan v. United States Fidelity & Guaranty Company, 37 Wash. 481.)

The Highway Engineer and the Public*

By H. W. BOETZKES†

The functions of the highway engineer are generally considered to include only the solution of technical problems of road construction. While the value of science and technical skill in highway engineering are appreciated, it has been pointed out to the writer that in no other line of work does the engineer come into closer contact with the public, nor does his success depend more largely on the way he deals with questions with which the public is directly concerned.

Among all with whom the highway engineer deals, the traveling public which actually uses the roads should receive first and lasting consideration. Many of the duties of the highway engineer to the traveling public are obvious, but the traveling public is less often considered in connection with providing detours around construction work, guarding dangerous railway crossings, providing for the scenic development of highways, and providing public camping grounds for the benefit of the increasing number of camping tourists.

The duty of the highway engineer to the taxpayer is to spend the money intrusted to him for road construction in the most economical way possible. In this as in other construction work, economy does not always follow the line of least expenditure. True economy provides for a minimum cost of service based not only on the first cost of the work but also on the cost of maintenance plus interest on the first cost and maintenance costs.

In addition, two admitted points are submitted. The first is that the expenditure for grading and for the building of permanent drainage structures is the highest type of true economy. The second is that the service a road system will give to the public depends upon its mileage—the greater the mileage built, the greater number of people will be benefited.

It is to be regretted that the public is acquiring the false idea that the greater the cost of a certain stretch of road the greater is the service rendered by it. This attitude is constantly being fostered by the advertisement of the large sums expended and the value of the completed work. That the holding of such an opinion by the public will result in a reduction in the mileage of roads built is obvious. It will be admitted that some highways, for instance those adjacent to large cities, demand the highest type of construction; but, taking into consideration the large sections of small populations which must be served by roads, this tendency should be checked by educating the public. At present, an engineer hesitates to recommend the cheaper types of construction, which, as a matter of course, require early and constant maintenance. It is admitted that roads built without an artificial binder need the most attention immediately after completion and before the final settling and binding under traffic. With the present state of the public mind, the beginning of maintenance shortly after the completion of a road brings forth condemnation of the engineer and his work. The railroads after years of experience have doubtless adopted the right policy in building and maintaining their roadbeds. Their practice is based upon dollars and cents, and, broadly speaking, their problems are identical with those of the road builder. It will hardly be questioned that by using concrete bases and heavy rails roadbeds approaching permanency could be built and that, should such construction prove economical, funds for the work could be found.

Unquestionably, a man who satisfactorily completes a fine piece of road costing thousands of dollars is justified in feeling pride in his accomplishment. But consider the lowly road supervisor or county engineer who, figuratively speaking, has to count the pennies allotted to him. Suppose that by wheedling some money out of the county commissioners and perhaps obtaining some donation work from his neighbors, he succeeds in building and maintaining an excellent piece of gravel road. Does not his accomplishment compare favorably with that of his more favored brother?

By molding public opinion along such lines as the foregoing great good could be done, and something accomplished toward the fulfillment of the taxpayer's dream—"a dollar's worth of road service for a dollar of road taxes."

Between the highway engineer and the taxpayers stand the administrators of road funds, such as the county commissioners or analogous officials. In this connection there are some relations which may be interesting. As a class these officials are excellent citizens, who devote their time to public work for a compensation much less than that they receive for their everyday work. They can not always be men experienced in highway work, and they may sometimes be misguided by political or personal considerations, or may even be forced by public criticism to act contrary to their best judgment. In such a situation the highway engineer, following his true line of duty, can to the fullest extent use his position for the good of the cause, and can incidentally be of great value to his superiors and to the taxpayers.

At present, the highway engineer is too prone to allow himself to be relegated to the capacity of transitman or stake driver, and to leave the larger questions to the men above him. The highway engineer can, however, without assuming undue authority but by using diplomacy backed by sound judgment, mold not only the decisions of his employers but allay unjust and dangerous criticism on the part of the public. And there is no doubt that in the long run he will be rewarded.

The remaining portion of the public with which the highway engineer has to deal consists of the contractors and material men. Though, as a class, the contractor has been much maligned, it has been the writer's experience that the majority of men who do constructive work in road building take pride in the quality of their work, and that great results can be obtained by taking advantage of this fact. The effects of this pride in their work will be especially productive of good results in those cases in which the selection of contractors to do work is both legal and feasible.

It is believed that the material man, like the contractor, is too often thought to be interested only in his profits. In this case, too, we must consider the value of business integrity and reputation. And there is another point to be considered. Conditions are rapidly proving the man who sells material or equipment to be an expert in his own line. He can no longer hold his own by being merely a good salesman. He must know the economics and the best practices in his line. With this in view, it would seem to be good business sense in dealing with a material or an equipment man to consider him not only as a man who is trying to sell something, but as an expert whose statements, though perhaps colored by his enthusiasm and ambition, often contain excellent advice based on large experience.

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Recent Developments in Bituminous Macadam and Bituminous Concrete Pavements

By ARTHUR H. BLANCHARD[†]

Before proceeding with the discussion of the many improvements in the construction of bituminous macadam and bituminous concrete pavements which have been developed during the period from 1914 to 1916, it is advisable, in order to avoid misunderstandings, to quote the definitions of the two types of pavements as recommended by the Special Committee on "Materials for Road Construction" of the American Society of Civil Engineers.

> Bituminous Macadam Pavement. One having a wearing course of macadam with the interstices filled by penetration methods with a bituminous binder.
>
> Bituminous Concrete Pavement. One composed of stone, gravel, sand, shell or slag, or combinations thereof, and bituminous materials incorporated together by mixing methods.

General

Certain developments which are common to both classes of bituminous pavements will be discussed prior to considering improvements which specifically refer to each of the several types.

Foundations.—There has been a general acknowledgment of the ultimate economy of constructing adequate foundations to support the amount and character of traffic which the several types of bituminous pavements are able to carry. In the case of bituminous macadam pavements, this development usualy has been characterized by the construction of well compacted and, in many cases, thoroughly filled broken stone foundations. In the case of bituminous concrete pavements, due to numerous failures which have occurred where this type of pavement has been built on old macadam or poorly constructed broken stone foundations, there has been a general tendency to advocate the use of cement concrete foundations from 4 to 6 ins. in thickness. It has generally been found that the cost of cement concrete foundations does not exceed the cost of well compacted and filled broken stone foundations of equivalent strength. Furthermore, the use of cement concrete foundations renders repairs and renewals more satisfactory and much easier of accomplishment.

Non-Bituminous Highway Materials.—There has been a general recognition since 1914 of the desirability of covering in specifications in more detail and with greater rigidity the physical properties of the aggregates to be employed and the sizes of the particles which compose such aggregates. For example, the 1914 specifications of the American Society of Municipal Improvements covering bituminous macadam pavements state, with reference to the physical properties of the stone, that the rock employed must meet the folowing requirements:

> The broken stone shall be subjected to abrasion tests and toughness tests conducted by the engineer in accordance with methods adopted by the American Society for Testing Materials, August 15, 1908. The broken stone used for the construction of the first and second courses shall show a French coefficient of wear of not less than 7.0 and its toughness shall be not less than 6.0. The broken stone used for the construction of the third course and for the first and second applications of No. 1 broken stone shall show a French coefficient of wear of not less than 11.0 and its toughness shall not be less than 13.0.

The necessity for more carefully drawn specifications covering the sizes of the particles of which a given product of a stone crushing and screening plant is composed is illustrated by the following mechanical analyses of two products obtained from the same plant, both of which products passed over a section of a rotary screen having circular holes of 1¼ ins. and through a section of a rotary screen having circular holes 2¼ ins. in diameter.

Material.	Per cent. Sample "A"	Per cent. Sample "B"
Passing ⅛-in. screen	0.2	0.1
Passing ¼-in. "	0.1	0.1
Passing ½-in. "	0.4	1.1
Passing ¾-in. "	2.2	12.6
Passing 1 -in. "	8.0	37.5
Passing 1¼-in. "	29.1	40.9
Passing 1½-in. "	27.1	7.7
Passing 2 -in. "	32.9	0.0
	100.0	100.0

It is hence obvious that for many forms of bituminous construction, in order to secure successful results, greater care must be used in the writing of specifications for products of broken stone. As an illustration of an improvement in specifications covering this detail, there are cited those adopted at the 1915 Convention of the American Society of Muncipal Improvements covering broken stone to be used for the aggregate of one type of bituminous concrete pavement.

> Broken stone for the mineral aggregate of the wearing course shall consist of one product of a stone crushing and screening plant. It shall conform to the following mechanical analysis, using laboratory screens having circular openings: All of the broken stone shall pass a one and one-quarter (1¼) inch screen; not more than ten (10) per cent. nor less than one (1) per cent. shall be retained upon a one (1) inch screen; not more than ten (10) per cent. nor less than three (3) per cent. shall pass a one-quarter (¼) inch screen.

It is noted that in this form of specification an attempt is made to cover in the mechanical analysis only the limits of the smallest and largest particles. No attempt is made to secure a carefully graded aggregate but simply a product suitable for the type of pavement in question and uniform in character. For example, the following mechanical analyses show three products used in the successful construction of three different bituminous concrete pavements of the type mentioned.

Material.	Per cent. Sample "A"	Per cent. Sample "B"	Per cent. Sample "C"
Passing ⅛-in. screen	1.2	2.7	1.0
Passing ¼-in. "	4.2	5.6	2.5
Passing ½-in. "	34.7	45.0	30.8
Passing ¾-in. "	40.6	35.1	34.2
Passing 1 -in. "	17.3	10.1	23.4
Passing 1¼-in. "	2.0	1.5	8.1
	100.0	100.0	100.0

Bituminous Materials.—There has recently been considerable discussion pertaining to the advisability of the adoption of so-called "alternate type" specifications in preference to the so-called "blanket" specifications for bituminous materials. By alternate type specifications is meant a series of specifications, each of which covers the physical and chemical properties of the most desirable grade of a given type of bituminous cement for the purposes for which it is to be used. On the other hand a blanket specification covers in one set of requirements, pertaining to physical and chemical properties, all the types of bituminous cement which are to be used in connection with the construction of a given kind of pavement. For example, in the case of specifications for asphalt cement for bituminous concrete pavements, it would be desirable under alternate type specifications to have not less than five sets of physical and chemical requirements, the limits for each requirement being as narrow as the several processes of manufacture would permit, while on the other hand a blanket specification would cover

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with a wider range of limits the same chemical and physical properties for the five types mentioned. As an illustration will be cited the limits in the cases of specifications "A" to "E" inclusive, under the alternate type specification method for specific gravity, and the penetration at 25° C. (77° F.).

	"A"	"B"	"C"	"D"	"E"
Sp. Gr...	0.97—1.00	1.00—1.03	1.03—1.04	1.025—1.05	1.04—1.06
Pent.....	75— 90	90—100	70— 90	85— 95	140—160

In the case of a blanket specification to cover the same grades of the several types the limits for specific gravity would have to be 0.97 to 1.06 and the limits for penetration would be 70 to 160. The penetration test, for example, can only be of maximum value when applied to the grade of a specific type of bituminous cement which is most suitable for the type of pavement in question. In the case of the bituminous concrete pavement of the type mentioned the proper penetration limits for a California asphalt lie between 70 and 90, while for a fluxed Bermudez asphalt to be used in exactly the same type of pavement and under the same conditions, the penetration limits should be between 140 and 160. It is evident that to attempt to cover the penetration limits for both materials in one specification is impracticable. In the first place such limits as 70 to 160 are so wide as to insure but little uniformity in different lots of the same material and in the second place an entirely unsuitable material of one class could be supplied under the maximum or minimum test limits of the other class.

The proper use of alternate type specifications allows the contractor to bid to supply so many tons of bitumen which will comply with any one of the sets of requirements. It will be noted, therefore, that the contractor is in exactly the same position as in the case when he bids to supply any asphalt cement which will comply with the requirements of a blanket specification.

Guarantees.—There has been a general tendency to abandon the use of guarantees on bituminous pavements as it is believed that, with proper specifications and efficient supervision and inspection, guarantees are not necessary and that the requirement of a guarantee materially increases the prices bid on a given pavement. The subject of guarantees is too broad to discuss in this paper, but it should be noted that under the title "The Economics of Guarantees of Pavements on State and Municipal Highways," it has been admirably treated by Mr. George C. Warren in a lecture in the Graduate Course in Highway Engineering at Columbia University, which lecture has been published under the auspices of the National Highways Association.

Bituminous Macadam Pavements

In addition to the improvements noted above, the most notable recent development in the construction of bituminous macadam pavements has been in connection with the compaction of the road metal and the distribution of the bituminous materials.

As a result of the numerous failures of bituminous macadam pavements which have occurred, due to the improper rolling of wearing courses of road metal prior to the application of bituminous material, there has been a general recognition of the necessity for more thorough compaction of the road metal. This principle has been recognized by the Special Committee on "Materials for Road Construction" of the American Society of Civil Engineers in its 1915 report, the conclusion referred to reading as follows:

> An important factor for successful results is the proper compaction by rolling of the road metal before the spreading of the bituminous material.

The above committee emphasizes another improvement which is aimed at the use, in some cases, of an excess amount of bituminous cement in this type of pavement. The conclusion is as follows:

> Present indications are to the effect that the use of bituminous materials in quantities of more than 2½ gals. per sq. yd. where the upper course of the macadam is to be 3 ins. in thickness after compaction is inadvisable under the penetration method.

There has been a general recognition of the advisability of using properly designed distributors in connection with the application of bituminous materials in order to secure uniform distribution economically. Some specifications cover the requirements which a distributor must meet. For example, the 1914 specifications of the American Society of Municipal Improvements contain the following paragraph pertaining to the pressure distributor.

> The pressure distributor employed shall be so designed and operated as to distribute the bituminous materials specified uniformly under a pressure of not less than twenty (20) pounds nor more than seventy-five (75) pounds per square inch in the amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the bituminous material and with an accurate pressure gauge so located as to be easily observed by the engineer while walking beside the distributor. It shall be so operated that, at the termination of each run, the bituminous material will be at once shut off. It shall be so designed that the normal width of application shall be not less than six (6) feet and so that it will be possible on either side of the machine to apply widths of not more than two (2) feet. The distributor shall be provided with wheels having tires each of which shall not be less than eighteen (18) inches in width, the allowed maximum pressure per square inch of tire being dependent upon the following relationship between the aforesaid pressure and the diameter of the wheel: For a two (2) foot diameter wheel, two hundred and fifty (250) pounds shall be the maximum pressure per linear inch of width of tire per wheel, an additional pressure of twenty (20) pounds per inch being allowed for each additional three (3) inches in diameter.

This specification provides for a distributor by which it is practicable, under competent supervision, to secure uniform application of the bituminous material and allows the use of a pressure distributor without danger of rutting of the wearing course of broken stone by narrow tires carrying excessive weights.

Bituminous Concrete Pavements

The improvements in the construction of bituminous concrete pavements to which attention should be called will be considered under the following classification of the three types into which bituminous concrete pavements generally may be divided. These types are designated as follows:

(A) A bituminous concrete pavement having a mineral aggregate composed of one product of a crushing and screening plant.

(B) A bituminous concrete pavement having a mineral aggregate composed of a certain number of parts by weight or volume of one product of a crushing and screening plant and a certain number of parts by weight or volume of fine mineral matter such as sand or stone screenings.

(C) A bituminous concrete pavement having a predetermined mechanically graded aggregate of broken stone or gravel, either alone or combined with fine mineral matter, such as sand or broken stone screenings.

Patents.—Unfortunately the present status of patent litigation has to be considered in connection with the discussion of the several types of bituminous concrete pavements. The majority of engineers and highway officials are interested in the types of bituminous concrete pavements which may be constructed without danger of litigation rather than in a prolonged discussion of the probabilities of successfully defending suits for infringement. There is ample evidence at hand that bituminous concrete pavements of type "A" may be constructed without danger of litigation proceedings provided that the mineral aggregate is of the general character heretofore mentioned in this paper under the section "General; Non-Bituminous Highway Materials."

The history of litigation cases indicates that the construction of bituminous concrete pavements of type "B" on a large scale will in all probability lead to litigation. The same remarks apply to the construction of bituminous concrete pavements of type "C" except in the case of the so-called Topeka bituminous concrete pavement with an aggregate of the type specified either in the 1910 Topeka decree, or of the grading which was adopted at the 1915 convention of the American Society of Municipal Improvements.

TYPE (A).—Materials.—Practice has demonstrated that broken stone, because of the satisfactory mechanical bond secured, makes the most suitable aggregate for this class of bituminous concrete, although pavements constructed with gravel have proved satisfactory for light traffic where great care has been taken in the selection of the gravel and in the construction of the pavement. The development of the character of materials used in current practice has been covered in this paper under the title "General." Much more care has been taken in recent years with reference to the quantity of bituminous cement to be used in the mix. There has been a general recognition that the amount used depends upon the kind of road metal and the bituminous material, the character of the aggregate and the climatic conditions. For the product of broken stone heretofore mentioned, it has been found that bituminous concrete mixtures should contain between 5 and 8 per cent. by weight of bitumen.

Mixing.—Many improvements are noted in the methods employed in the mixing of bituminous concretes. There has been a general evolution from hand mixing methods to the utilization of mechanical mixers especially designed for the manufacture of this type of bituminous concrete. The large contract for 35 miles of bituminous concrete pavement of this type around the Ashokan Reservoir, constructed under the direction of the Board of Water Supply of the City of New York, demonstrated the desirability of the manufacture of a plant especially designed for this class of work. The type finally evolved showed that it is practicable and economical to use a self-propelled plant, consisting of elevators, a rotary drier, weighing devices and a mixer, having a capacity of from 800 to 1,000 sq. yds. of 2-in. wearing course per day. Experience has demonstrated that, except on small contracts and for repair work, mixers which provide for the heating of broken stone by the use of a flame in the chamber should not be used on account of the danger of burning the broken stone or the bituminous concrete.

Laying.—There has been considerable discussion pertaining to the proper type and weight of roller to be used for the compaction of the wearing course. Experience demonstrates that in order to secure an even surface and adequate compaction by thorough interlocking of the particles of broken stone, a tandem roller weighing between 10 and 12 tons should be used.

Seal Coat.—Many methods have been developed for the application of the seal coat of bituminous material. It has been found that seal coats of from ½ to 1 gal. per sq. yd. of bituminous cement are distributed most uniformly by the use of hand-drawn gravity distributors followed by a squeegee.

Seasonal Limitations.—Experience in many localities has demonstrated that bituminous concrete of this type should not be mixed or laid when the air temperature in the shade is below 50° F. as otherwise it is difficult, under average conditions, to secure an even and well compacted wearing course.

TYPE (B).—Specifications for this type of pavement have, during recent years, generally stipulated that so many parts of broken stone and so many parts of sand or other fine material are to be mixed with a certain amount of bituminous cement. By the use of this specification, unless employed under unusual supervision, it has been found to be impracticable to secure a well graded aggregate. In many cases the mixture has contained an excess of broken stone with insufficient fine material to fill the voids therein, while in other cases it has contained an excess of sand in which the broken stone exists as isolated particles. It is the conclusion of many engineers, because of the conditions described, that when bituminous concrete pavements are to be employed either type "A" or type "C" should be selected.

TYPE (C).—During recent years, the bituminous concrete pavements of this type which have been most extensively employed are known as Bitulithic, Warrenite and Topeka.

Bitulithic and Warrenite; Differentiation.—The general use of Bitulithic and Warrenite bituminous concrete pavements throughout America has brought up for discussion the matter of the fundamental differences between these two types of patented pavements. It is believed that it will be of interest and value to the engineering profession to submit the following statement, prepared by Mr. George C. Warren, President of the Warren Brothers Co., for the information of the engineers enrolled in the Graduate Course in Highway Engineering at Columbia University.

> Bitulithic and Warrenite mixtures are both made under the provisions of the Warren patents, which the courts have held "cover the product no mater how produced." Bitulithic is designed to meet the conditions generally prevailing on city streets, and Warrenite is to meet such conditions as may arise on country roads so as to meet the physical and economic conditions and public demands as to cost.
>
> Generally speaking, Bitulithic is mixed by a plant which is too cumbersome to meet country road conditions, which provides for combining the materials proportioned by separation of sizes of the aggregate, after heating, and then recombining by weight.
>
> Warrenite is, generally speaking, mixed by a plant so portable that it may be set up either alongside the railroad; along the side of the road being constructed, or in the quarry or gravel bank from which the bulk of the aggregate is being procured as may be most economical in any particular case. This plant is constructed on the principle of proportioning the several separated sizes by careful measurement by bulk before heating and retaining the batch so measured as a separate entity through the process of heating and delivery into the mixer in which the bituminous cement is added.
>
> Generally speaking, crushed stone predominates in the fine aggregate of Bitulithic, while sand predominates in the fine aggregate of Warrenite; also, fine crushed stone and sand respectively are correspondingly used for the seal coat aggregate.
>
> In the selection of quality of material (whether gravel or crushed stone) for the coarse aggregate a greater latitude is permitted in the case of Warrenite to practically meet the conditions of less opportunity for selections which are liable to prevail in localities at considerable distances from railroad centers. This latitude is allowed, because, while the traffic conditions on country road thoroughfares are in point of weight and concentration of traffic rapidly becoming fully as severe as on most city streets, there is the important difference that on country roads generally the traffic is more exclusively of the motor vehicle rubber tire type and consequently less exaction in physical properties of the quality of the stone forming the basis of the aggregate is necessary. Also, unfortunately, many city streets are abused by constant excessive sprinkling or daily scoured by pressure flushing machines, a practice which is more or less injurious to any road surface, while country roads are seldom, if ever, wet except by rainfall; therefore, in cases where the very best quality of stone is unavailable, it would be safe to use stone of slightly lower quality in Warrenite on a country road although the same quality stone might not be safe for use in Bitulithic on a city street.

Topeka.—In many specifications the mineral aggregate for the Topeka pavement specified has been that contained in the decree of 1910, namely,

Bitumen from 7 to 11 per cent.
Mineral aggregate, passing 200-mesh screen, from 5 to 11%
" " " 40 " " " 18 to 30%
" " " 10 " " " 25 to 55%
" " " 4 " " " 8 to 22%
" " " 2 " " less than 10%

Many unsatisfactory pavements have resulted by the unintelligent use of this grading. It has been found necessary, in order to secure successful results, to specifically define the character of the sand or other fine material which shall be employed in order to secure a satisfactory grading. Many specifications now cover the sand grading with almost the same care as in the case of sand grading requirements for sheet asphalt pavements. In order to encourage the use of a more satisfactory grading for this type of pavement, the American Society of Municipal Improvements in 1915 recommended the adoption of the following grading:

Passing	200	-mesh	screen......................						7—10%
“	80	“	“	but	retained	on	a	200,	10—20%
“	40	“	“	“	“	“	an	80,	10—25%
“	20	“	“	“	“	“	a	40,	10—25%
“	8	“	“	“	“	“	a	20,	10—20%
“	4	“	“	“	“	“	an	8,	15—20%
“	2	“	“	“	“	“	a	4,	5—10%

A Bill for Federal Aid

As was noted in the issue of May 13, a bill providing for federal aid to the various states in the construction of roads was passed by the United States Senate on May 8.

Soon after Congress convened in its present session, many bills providing for federal aid were introduced, among them, one by Dorsey W. Shackleford, of Missouri (H. R. 7617), which was passed by the House of Representatives on January 25. An abstract of this bill was printed in "Good Roads" for February 5. After being sent to the Senate, the bill was referred to the committee on Post Offices and Post Roads. The bill was amended and, after conferences with the Agricultural Department, was reported unanimously by the committee. During the weeks preceding its final passage by the Senate, the bill was very thoroughly discussed by that body and several amendments were offered and accepted, among them, Section 8, which provides for the construction of roads in the national forests.

At the time this was written the bill had not been acted upon in conference but it was expected that it would receive favorable consideration there and that it would be signed by the President. The bill follows:

"An Act to provide that the United States shall aid the States in the construction of rural post roads and for other purposes.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

"That the Secretary of Agriculture is authorized to cooperate with the States, through their respective State highway departments, in the construction of rural post roads; but no money apportioned under this Act to any State shall be expended therein until its legislature shall have assented to the provisions of this Act, except that, until the final adjournment of the first regular session of the legislature held after the passage of this Act, the assent of the governor of the State shall be sufficient. The Secretary of Agriculture and the State highway department of each State shall agree upon the roads to be constructed therein and the character and method of construction: Provided, that all roads constructed under the provisions of this Act shall be free from tolls of all kinds, nor shall any of the money appropriated under this Act be used for constructing extensions of, or mere branch roads out from, toll roads.

"Sec. 2. That for the purpose of this Act the term 'rural post road' shall be construed to mean any public road over which the United States mails now are or may hereafter be transported, excluding every street and road in a place having a population, as shown by the latest available Federal census, of two thousand five hundred or more, except that portion of any such street or road along which the houses average more than two hundred feet apart; the term 'State highway department' shall be construed to include any department of another name, or commission, or official or officials, of a State empowered, under its laws, to exercise the functions ordinarily exercised by a State highway department; the term 'construction' shall be construed to include reconstruction and improvement of roads not constructed under this Act; 'properly maintained' shall be construed to mean in practically as good condition as when it was first built; necessary bridges and culverts shall be deemed parts of the respective roads covered by the provisions of this Act.

"Sec. 3. That for the purpose of carrying out the provisions of this Act there is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, nineteen hundred and seventeen, the sum of $5,000,000; for the fiscal year ending June thirtieth, nineteen hundred and eighteen, the sum of $10,000,000; for the fiscal year ending June thirtieth, nineteen hundred and nineteen, the sum of $15,000,000; for the fiscal year ending June thirtieth, nineteen hundred and twenty, the sum of $20,000,000; and for the fiscal year ending June thirtieth, nineteen hundred and twenty-one, the sum of $25,000,000. So much of the appropriation apportioned to any State for any fiscal year as remains unexpended at the close thereof shall be available for expenditure in that State until the close of the succeeding fiscal year, except that amounts apportioned for any fiscal year to any State which has not a State highway department shall be available for expenditure in that State until the close of the third fiscal year succeeding the close of the fiscal year for which such apportionment was made. Any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned, within sixty days thereafter, to all the States in the same manner and on the same basis, and certified to the Secretary of the Treasury and to the State highway departments and to the governors of States having no State highway departments in the same way as if it were being apportioned under this Act for the first time; provided, that in States where the constitution prohibits the State from engaging in any work of internal improvements, then the amount of the appropriation under this Act apportioned to any such State shall be turned over to the highway department of the State or to the governor of said State to be expended under the provisions of this Act and under the rules and regulations of the Department of Agriculture, when any number of counties in any such State shall appropriate or provide the proportion or share needed to be raised in order to entitle such State to its part of the appropriation apportioned under this Act.

"Sec. 4. That so much, not to exceed five per centum of the appropriation for any fiscal year made by or under this Act as the Secretary of Agriculture may estimate to be necessary for administering the provisions of this Act shall be deducted for that purpose, available until expended. Within sixty days after the close of each fiscal year the Secretary of Agriculture shall determine what part, if any, of the sums theretofore deducted for administering the provisions of this Act will not be needed for that purpose and apportion such part, if any, for the fiscal year then current in the same manner and on the same basis, and certify it to the Secretary of the Treasury and to the State highway departments, and to the governors of States having no State highway departments, in the same way as other amounts authorized by this Act to be apportioned among all the States for such current fiscal year. The Secretary of Agriculture, after making the deduction authorized by this section, shall apportion the remainder of the appropriation for each fiscal year among the several States in the following manner: One-third in the ratio which the area of each State bears to the total area of all the States; one-third in the ratio which the population of each State bears to the total population of all the States, as shown by the latest available Federal census; one-third in the ratio which the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery routes and star routes in all the States, at the close of the next preceding fiscal year, as shown by the certificate of the Postmaster General, which he is directed to make and furnish annually to the Secretary of Agriculture.

"Sec. 5. That within sixty days after the approval of this Act the Secretary of Agriculture shall certify to the Secretary of the Treasury and to each State highway department and to the governor of each State having no State highway department the sum which he has estimated to be deducted for administering the provisions of this Act and the sum which he has apportioned to each State for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and on or before January twentieth next preceding the commencement of each succeeding fiscal year shall make like certificates for such fiscal year. The Secretary of Agriculture and the State highway department of each State may jointly determine at what times, and in what amounts, payments, as work progresses, shall be made under this Act. Such payments shall be made by the Secretary of the Treasury, on warrants drawn by the Secretary of Agriculture, to such official, or officials, or depository, as may be designated by the State highway department and authorized under the laws of the State to receive public funds of the State or county.

"Sec. 6. That any State desiring to avail itself of the benefits of this Act shall, by its State highway department, submit to the Secretary of Agriculture project statements setting forth proposed construction of any rural post road or roads therein. If the Secretary of Agriculture approve a project, the State highway department shall furnish to him such surveys, plans, specifications and estimates therefor as he may require: Provided, however, That the Secretary of Agriculture shall approve only such projects as may be substantial in character and the expenditure of funds hereby authorized shall be applied only to such improvements. Items included for engineering, inspection, and unforeseen contingencies shall not exceed ten per centum of the total estimated cost of the work. If the Secretary of Agriculture approves the plans, specifications, and estimates, he shall notify the State highway department and immediately certify the fact to the Secretary of the Treasury. The Secretary of the Treasury shall thereupon set aside the share of the United States payable under this Act on account of such project, which shall not exceed fifty per centum of the total estimated cost thereof. No payment of any money apportioned under this Act shall be made on any project until such statement of the project, and the plans, specifications, and estimates therefor, shall have been submitted to and approved by the Secretary of Agriculture; nor until there shall have been made available for expenditure by or on behalf of said State on the project money, labor, and material in such amounts, at such prices and such terms as may be agreed on between the Secretary of Agriculture and the State highway department, the aggregate amount to be not less than the amount to be received from the United States for expenditure on such project; nor until an agreement shall have been made with the Secretary of Agriculture, to his satisfaction, that the rural post road or roads so to be constructed under such project will be properly maintained by the State, or any subdivision thereof, for a period of not less than ten years from approved completion of construction; nor shall any such payment be in excess of $10,000 per mile, exclusive of the cost of bridges of more than twenty feet clear span. The construction work and labor in each State shall be done in accordance with its laws, and under the direct supervision of the State highway department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations made pursuant to this Act.

"Sec. 7. That the Secretary of Agriculture shall withhold apportionment of funds to any State in which roads constructed under the provisions of this Act have not been properly maintained by the State, or any subdivision thereof, if within four months after he has given notice in writing to the State highway department such roads shall not be properly maintained by the State, or any subdivision thereof. The Secretary of Agriculture is also authorized temporarily to decline to issue warrants under this Act upon failure on the part of any State, or its State highway department, to comply with the provisions of this Act or upon breach of agreement made with him pursuant to this Act; and finally to decline to issue such warrants if, within three months after he has given notice in writing to the State highway department, such failure be not corrected or such breach be not remedied to his satisfaction. If he withhold an apportionment or finally decline to issue a warrant under this section, the Secretary of Agriculture shall certify the reasons therefor to the Secretary of the Treasury and to the State highway department before the close of the fiscal year in which such action is taken and shall report the same to the next regular session of Congress.

"Sec. 8. That there is hereby appropriated and made available until expended, out of any moneys in the National Treasury not otherwise appropriated, the sum of $1,000,000 for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and each fiscal year thereafter, up to and including the fiscal year ending June thirtieth, nineteen hundred and twenty-six, in all $10,000,000, to be available until expended under the supervision of the Secretary of Agriculture, upon request from the proper officers of the State, Territory, or county for the survey, construction, and maintenance of roads and trails within or only partly within the national forests, when necessary for the use and development of resources upon which communities within and adjacent to the national forests are dependent: Provided, That the State, Territory, or county shall enter into a cooperative agreement with the Secretary of Agriculture for the survey, construction and maintenance of such roads or trails upon a basis equitable to both the State, Territory, or county and the United States; and provided also that the aggregate expenditures in any State, Territory or county shall not exceed ten per centum of the value, as determined by the Secretary of Agriculture, of the timber and forage resources which are or will be available for income upon the national forest lands within the respective county or counties wherein the roads or trails will be constructed; and the Secretary of Agriculture shall make annual report to Congress of the amounts expended hereunder.

"That immediately upon the execution of any cooperative agreement hereunder the Secretary of Agriculture shall notify the Secretary of the Treasury of the amount to be expended by the United States within or adjacent to any national forest thereunder, and beginning with the next fiscal year and each fiscal year thereafter the Secretary of the Treasury shall apply from any and all revenues from such forest ten per centum thereof to reimburse the United States for expenditures made under such agreement until the whole amount advanced under such agreement shall have been returned from the receipts from such national forest.

"Sec. 9. That out of the appropriations made by or under this Act the Secretary of Agriculture is authorized to employ such assistants, clerks and other persons in the city of Washington and elsewhere, to be taken from the eligible lists of the Civil Service Commission, to rent buildings outside of the city of Washington, to purchase such supplies, material, equipment, office fixtures and apparatus, and to incur such travel and other expense as he may deem necessary for carrying out the purposes of this Act.

"Sec. 10. That the Secretary of Agriculture is authorized to make rules and regulations for carrying out the provisions of this Act.

"Sec. 11. That this Act shall be in force from the date of its passage."

The "Mysteries" of Concrete Road Construction

That a "lack of thoroughness in the American people, plus shortsightedness of the cement manufacturers in not more actively discouraging inferior workmanship" is the reason for what he terms the "mysteries" of concrete road construction, was the conclusion reached by President W. H. Reed of the Washington State Association of County Commissioners in a paper presented at the Road Builders' Institute held at the University of Washington at Seattle last month.

The paper as a whole is an interesting discussion of certain details of the methods of constructing cement concrete roads. These are designated as "mysteries" by President Reed and are considered under the following heads: Subgrade, one- or two-course concrete, mineral aggregate, time of mixing, steel plates, curing and protection, and cracks.

Under each of these headings President Reed discussed the subject at some length, pointing out differences in the practice of various engineers and in their opinions as to the proper methods of construction.

In discussing subgrade, President Reed pointed out the divergent views as to cross section held by various road builders. The "mystery" in this case, according to President Reed, is that at this time highway engineers of acknowledged ability differ as to whether the subgrade should be crowned or flat, while some even advocate a dished subgrade.

Under the heading, "one- or two-course concrete," President Reed stated that until recently the leading highway engineers of the country had recommended two-course pavements and that until the holding of the Second National Conference on Concrete Road Building at Chicago this year no gathering of engineers had been willing to declare itself on this question. After quoting a resolution passed by that gathering to the effect that the one-course method of construction should be followed when the materials most readily available are such as to give good construction in a one-course pavement, President Reed asked why this was not commonly known long ago.

The point made by President Reed in the consideration of the mineral aggregate was the grading of the material for the purpose of reducing the voids. He pointed out that while for a number of years a grading giving a very small percentage of voids had been used in the construction of bitumen bound stone roads, engineers had only recently applied the same principle to the construction of cement concrete pavements.

The time of mixing of concrete for paving construction, according to President Reed, has been the subject of wide difference in opinion. He stated that until recently no attempt had been made to determine the economical length of time of mixing, although the knowledge was easily obtainable through tests. He cited work by the State Highway Department of Pennsylvania and by the builders of the Coleman du Pont Road in requiring mixing for 1½ minutes. In this connection he referred to experiments made under the direction of the Pennsylvania State Highway Department leading to the adoption of 1½ minutes as the time for mixing on one piece of work, and also to the specification of the same length of time for mixing on the Coleman du Pont Road in Delaware.

Steel protection plates for joints in concrete pavements were not favored by President Reed. In considering this point he again quoted the resolutions adopted at the Second National Conference on Concrete Road Building, which, he stated, were to the effect that the tendency of present practice is toward the omission of metal protection plates for joints, and pointed out that this matter had been the subject of much difference of opinion.

That the usual time for closing a newly built concrete pavement to traffic is too short was the belief of President Reed. He pointed out the difficulty of keeping a road closed for a sufficient length of time because of the insistence of the public on using pavements as soon as completed, but held that at least 60 days should be allowed for the proper curing of the concrete.

In discussing cracks in concrete pavements, President Reed referred to reports by several engineers on concrete pavements of varying ages which did not show cracks. He also quoted a statement to the effect that it is coming to be the belief of practically all highway engineers that, given good foundation and drainage, the most common cause of cracking is the use of too much water in the mixture. Mr. Reed inquired why it had taken so long for highway engineers to begin to realize this.

Engineers for Road Builders

The desirability of placing road work under the charge of engineers was emphasized in a paper read by William Kelly, Chairman of the Board of County Road Commissioners of Dickinson County, Michigan, at the 1916 session of the Short Course in Highway Engineering given under the auspices of the University of Michigan.

The opening paragraph of Commissioner Kelly's paper was as follows:

"Road building is an engineering operation. The time has gone by when the building of our roads can be left to men who do not know present day requirements, the nature of road materials, and modern methods of utilizing them."

The main portion of the paper was taken up by a discussion of some of the common faults in road building by laymen and a resume of some of the principles to be observed in the location and construction of country roads. Commissioner Kelly pointed out that while his discussion contained nothing new as regards methods, the points brought out served to emphasize the statement made at the beginning of the paper, that road building is an engineering operation. It necessarily follows, according to Commissioner Kelly, that the work should be in charge of engineers.

"This," he said, "does not mean that road building can be learned from books alone nor does it mean necessarily that a man must have a college degree. Many engineers have never has such opportunities as this and other universities and colleges offer. But it does mean that a man must have a knowledge of the fundamental principles involved, he must be conversant and in touch with practice elsewhere and above all have that inquiring and analytical attitude of mind which is the distinctive characteristic of an engineer."

Commissioner Kelly said that he believed that the most important duty of county road commissioners was the selection of the engineer to be the executive officer—the operating head of the organization in charge of all field work. Commissioner Kelly also stated that it had always been his belief that in every county there could be found three men sufficiently interested in securing good roads to serve as commissioners for a nominal salary, and who would expect their principal reward to be the satisfaction of improving the facilities, enhancing the wealth and increasing the pleasure of the community which they served.

The Operation and Care of the Road Roller*

By **W. HUBER** Assoc. M. Can. Soc. C. E.

The roller engineer to make a success of his work must be more than merely a good engineer; he must be a man of intelligence and good judgment, for the speed at which the work will proceed and the quality of the finished work will largely depend on him. He must be a student of his work, for, regardless of whatever instruction he may receive, his greatest source of knowledge will be his own experience. He must be able to detect his own mistakes and to correct them, and he must be ever on the alert to discover better and shorter ways of doing many of the things which are a part of his work. Observation, more than anything else, if he is the right kind of man, will teach him correct methods and enable him to work toward greater efficiency. The majority of roller engineers on our country roads are recruited from the ranks of threshing and traction engineers, and while, as a rule, fairly well versed in the art of running an engine and keeping it in repair, will require considerable instruction and experience, before they can be considered efficient roller operators. There is much more in operating a road roller than merely running it up and down the road, and only a man who has mastered the details of the work can be expected to do it with any degree of efficiency.

Having secured an engineer who can properly handle the roller, his first duty will be to see that it is put into good condition and kept there. Efficient rolling can be done only with a machine which is maintained in a maximum state of serviceability, and to that end any breaks or leaks should be given prompt attention.

A common cause of inferior rolling is worn wheels. Where the faces of the rear rolls become rounded, as they will in time, particularly when rolling narrow stone roads with high crowns, the work of consolidating the stone will be somewhat retarded, since the rounded edges of the rolls will tend to cause small ridges in the stone which must later be smoothed out with another section of the face of the rolls. A commendable feature of some makes of rollers is the fact that the rims of the rear rolls are detachable from the spokes and may be renewed without removing the hubs and spokes from the axles. In such cases the renewal of the rims is much less expensive than the purchase of entire new wheels.

To secure long life of a roller, as well as of any machine, lubrication must be carefully looked after. Only the best oil should be used, and this is particularly true of the selection of cylinder oil. The very best is none too good since an inferior oil which, while it may appear the same as the more expensive article, will not stand the high temperatures developed in a steam cylinder, is little better than none at all, and will sooner or later cause trouble by the cutting of cylinders and valves.

Most up-to-date rollers are now supplied with a positive feed lubricator for the cylinders in the form of a pump operated by the crosshead, which forces oil into the cylinders whenever the engine is running. As soon as the engine stops the flow of oil also ceases. There is no danger of damage to the cylinders through the engineer's forgetting to start the lubricator; neither is there any waste through his failure to shut it off when the engine stops. In the case of older machines if this is not part of the equipment it will pay to purchase one and have it attached.

It is hardly necessary to mention the desirability of keeping the engine running quietly, since almost the first test of an engineer is the condition in which his engine is running, and ordinary self-respect will usually induce him to give this part of his duties the attention it deserves. It may be said, however, that an engine in which knocking may be detected in every bearing is almost an infallible sign of an incompetent engineer.

The boiler portion of the roller will require as much care as the engine, closer attention, in fact, being necessary, since defects are not so apparent, and neglect may bring more serious consequences. A clean boiler is the first essential. Unfortunately there is often no choice but to use whatever water is available, which in many cases is far from pure. The only remedy is frequent blowing off of the boiler and washing at intervals, depending on the quality of water used. No matter how pure the water may appear, a portion of the contents of the boiler should be blown off every day or oftener, which will remove much of the sediment before it can become hard. The blowing off should be supplemented by frequent washing, and this may best be accomplished by using a short length of hose in conjunction with the pump on the water wagon. With an assistant to handle the pump the engineer can accomplish the work quickly and thoroughly, and in addition to lightening his work of firing, will have the satisfactory assurance that the machinery in his care is not depreciating faster than it should.

Neither should it be necessary to mention that the tubes of the boiler should be kept clean, since the engineer's own interest lies in so doing. Clean boiler tubes mean easier firing and more economical coal consumption.

Having worked faithfully all summer the roller has earned a comfortable rest for the winter. This can not be obtained in an open field with no protection except its own curtains. The cost of a roller is too high to permit deterioration during the winter months for no reason other than lack of a suitable shelter. If a barn or shed can not be secured for housing the large machinery, a substantial covering of rough lumber may be constructed at a small cost, and the lumber may be resold in the spring for part of its original cost, or stored for use the following winter. There is a growing tendency to provide a shed for the express purpose of storing all county machinery during the winter and other idle periods, and the comparatively low cost of such a building will soon be saved in decreased deterioration.

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*From a paper of the same title presented at the Second Conference on Road Construction for County Road Superintendents and Engineers, Toronto, Ont., February, 1916.

The Chambers of Commerce of Logan and Huntington, W. Va., are urging the construction of a highway between the two places.

A Good Roads Association has recently been formed in the Province of Santo Domingo, Dominican Republic. According to the "Bulletin of the Pan-American Union," the organization is composed of agriculturalists, and has for its object the promotion of better roads throughout the province.

Plans for Repaving the Queensboro Bridge at New York City have been approved and an appropriation for the work has been voted. The old pavement consisted of 4-in. wood blocks laid on a ½-in. cement and sand cushion resting on a 1:3:6 concrete foundation, laid on the buckle plates of the floor system. By 1911, after the pavement had been in service for something over two years, the pavement had become very uneven, and an investigation was undertaken to determine the cause of the failure. It was found that the principal cause was the deflection of the buckle plates. Since that time the matter has been studied carefully and a plan finally developed. A detailed explanation of the matter was made by E. A. Byrne, then Assistant Chief Engineer of the Department of Bridges (now Chief Engineer), in a discussion at the eleventh annual convention of the American Road Builders' Association, held at Chicago, Ill., in December, 1914. Mr. Byrne continued his investigations and is the designer of the method which it is now proposed to use. The method of construction to be followed in the repaving of the bridge includes the riveting of steel angles to the flat portions of the buckle plates, the laying of 3x12-in. planks over the stringers, and the use of 3-in. paving blocks instead of 4-in. blocks. Drainage is provided by grooves under the wood blocks leading to galvanized iron thimbles which extend vertically upward from the drainage holes at the lowest portions of the buckle plates. A 1:2:4 concrete will be used in the new work.

The New Route Between Pittsfield and Huntington, Massachusetts

By G. R. SMITH

One of the finest pieces of road improvement in western Massachusetts is the newly constructed state aid road between Pittsfield and Huntington by way of Peru Hill. The road shortens the route between Pittsfield and Springfield by about twelve miles and does away with the necessity of making the trip by way of the "Jacob's Ladder" route. This route has been unsatisfactory for automobile travel because of the condtion of the roads in the spring and because at all times of the year it is very windy.

The new route, while a scenic road that will take a large amount of tourist travel, is at the same time of considerable economic value as portions of it carry heavy commercial traffic.

The new route leads out from Pittsfield over Tyler St. and Dalton Ave. passes through Dalton, thence to Hinsdale and thence over Peru Hill to Huntington where it joins the state road to Westfield and Springfield. A view on a 3-mile section of macadam which passes through Dalton is shown in Fig 1. This macadam is built in accordance with the standard specifications of the Massachusetts Highway Commission. The roadway consists of a foundation course of stone passing a 2-in. screen, rolled to a thickness of 8 ins., and a wearing course 2 ins. deep. The wearing surface consists of stone of the same size as that in the foundation course, mixed with No. 6 tar distillate, spread, raked, and rolled to the required thickness. In general, an excavation was made to a depth of about 12 ins. at which depth a sound subgrade was usually secured. Where soft soil was encountered, telford was put down.

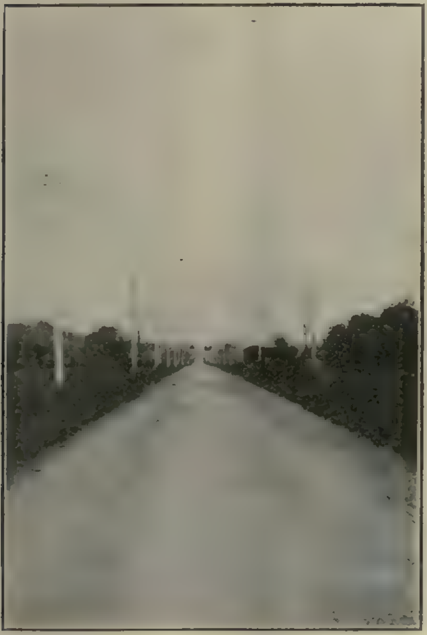
Fig. 1.—Macadam section near Dalton.

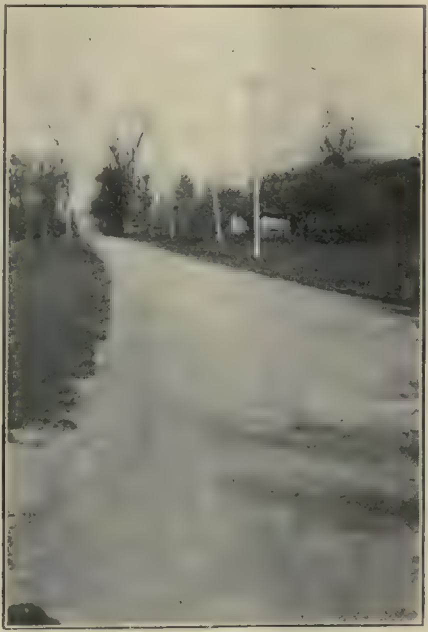
Fig. 2.—Macadam section at Hinsdale.

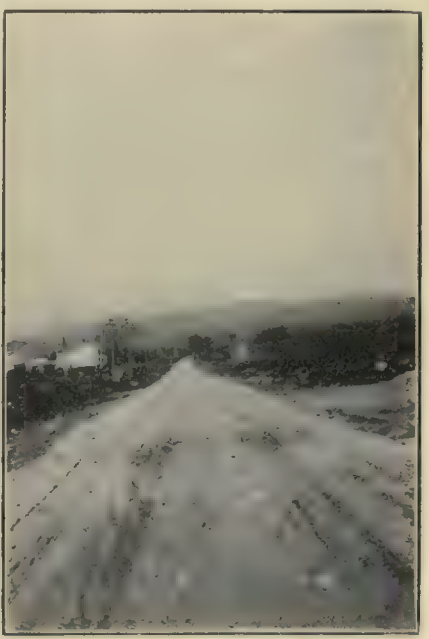
Fig. 3.—Telford section on Peru Hill.

VIEWS ON THE NEW ROUTE BETWEEN PITTSFIELD AND HUNTINGTON, MASS.

This particular section of road carries a heavy traffic, including some heavy motor trucking.

The stone used for both telford and macadam work consisted of bowlders obtained along the road, most of it of very good quality. It was broken in a crusher driven by a gasoline engine and carried from the crusher to the bins by a belt conveyor. The bins were elevated to allow wagons to be loaded by gravity. The cost of the stone, including hauling was about $1 per cu. yd. In Fig. IV is shown a pile of the stone used.

In Fig II is shown a portion of the road at Hinsdale. This is also of macadam, of the same construction as that of the section shown in Fig. I.

A section of road of telford construction on Peru Hill is shown in Fig. III. The road over the hill has been in bad condition for a number of years. The grade of the old road varied from 20 to 24 per cent. and the soil was a mixture of yellow clay and sand. Ordinarily it was very late in the spring before the frost was entirely out of the roadbed, with the result that the road was impassable until early summer. As soon as the roadbed thoroughly dried out, the sand became almost as troublesome as the mud in the spring. The mixture of fine sand and dried clay covered the road to a depth of from 4 to 12 ins., and after a rain would form a thick mire that was impassable for a heavy car. This section, which is about 7 miles long, is now one of the finest pieces of telford construction in that portion of the state. The present grade averages about 4 per cent. The maximum is 9 per cent. except for a short stretch where it is 19 per cent. This short pitch formerly had a grade of 24 per cent.

In the improvement of the road, the surface soil was excavated with road scrapers and hand labor to a depth of 24 ins., at which, in almost all places, hardpan or bed-rock was encountered. The grades were reduced, the road widened, and a standard telford pavement put down. The foundation course consisted of stones varying in size from 8 ins. to 2 ft. in diameter, compacted by hand ramming. The wearing course consisted of 10 ins. of screened gravel with a binder of stone dust. In various places it was necessary to build cribs of logs in sidehill construction.

At one point the old road crossed a narrow strip of land dividing Ashmere Lake. The lake is an artificial body of water which is a reservoir for the mills in Dalton, supplying water during the summer season when the flow of the streams is small. In the spring it has an area of about 1,000 acres, while during July and August it covers not more than 300 acres. The road at the lake has been widened and paved with telford, and a culvert of sufficient size to permit the passage of boats from one section of the lake to the other has been built. The culvert has a depth of 10 ft. from the bottom of the floor to the stream bed, and a span of 8 ft. The abutments are built of rough dressed blocks. The floor consists of a concrete slab 12 ins. thick, reinforced with railroad irons placed 12 ins. apart. Views on the Ashmere Lake section are shown in Figs. V and VI.

The paved portion of the road varies in width, the average being about 15 ft.

Bridge Floors*

BY ALMON H. FULLER†

The prevailing floors that I note on recent first class bridges have either concrete or creosoted plank bases. Six inches of reinforced concrete occurs so frequently that it can almost be said to predominate. The wearing surface is occasionally of concrete; more frequently of brick, wood block, asphalt or other paving material. There is no question but that this makes a most excellent floor. There is a question, however, whether it is economical to provide trusses to carry all of this weight. At any rate, an investigation of possible substitutes is in order.

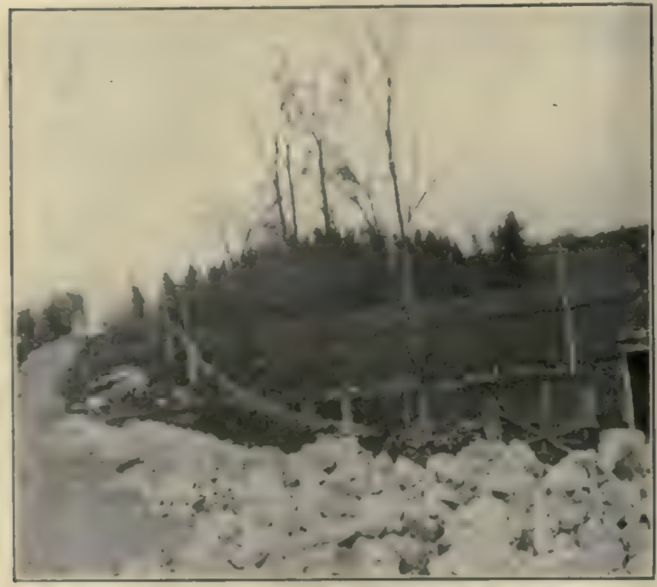

FIG. 4.—VIEW ON THE PITTSFIELD-HUNTINGTON ROAD SHOWING PILE OF STONE USED IN CONSTRUCTION.

Four inches of creosoted plank, covered with 3 to 4 ins. of creosoted wood block, makes a very satisfactory and durable bridge floor. Under the prevailing prices this will cost more than a concrete base with any of the prevailing wearing surfaces. It will weigh so much less than the heavier floors, however, that a decided saving in total cost of the structure is effected. The greatest objection to the creosoted floor that has been brought to my attention is the danger of fire. This has been so serious in a few instances that it seems necessary to consider the relation between the location of the bridge and the possibility of fire before deciding to use it. It seems to me to be a challenge to the timber men to develop a protective agency that has fire resisting qualities. With this accomplished, the wooden floor offers great possibilities.

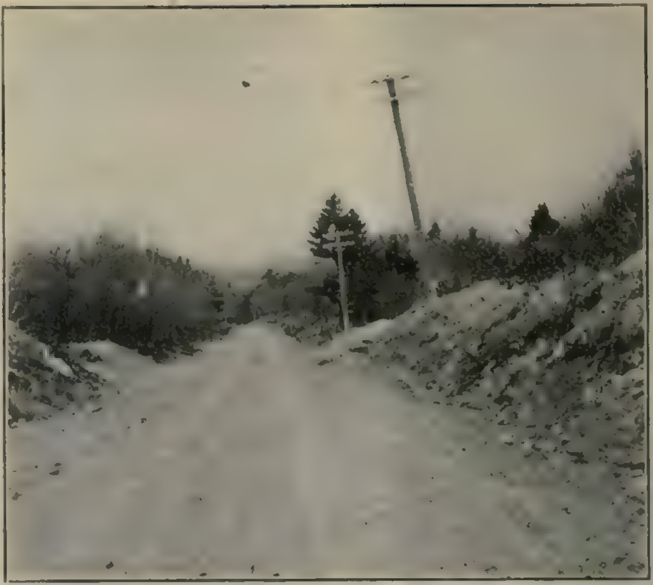

FIG. 5.—VIEW OF CUT AND FILL ON THE SO-CALLED ASHMERE LAKE SECTION.

The Illinois State Highway Commission is using with satisfaction, a floor consisting of a ¾-in. wearing surface of small gravel and bituminous material laid upon a 3-in. creosoted timber floor. This is reported to weigh about 26 lbs. per sq. ft. as against 32 lbs. per sq. ft. for the standard creosoted floor, and in the neighborhood of 100 lbs. per sq. ft. for the pavement with concrete base.

It is not the purpose in this paper to discuss comparative weights or costs; but it may be well to illustrate the above discussion in regard to the effect of the floors upon the weight and cost of structures by a few examples. Using the "ordinary highway bridge" with 100 lbs. per sq. ft. live load, 16-ft. roadway, and 3-in. plank floor as a basis for comparison, the steel in a bridge designed for the same load with an 8-in. creosoted floor will weigh from 15 to 25 per cent. more and the total cost will be from 35 to 50 per cent. greater. For a 100-lb. paved floor the excess weight of the steel will be from 55 to 65 per cent. and the excess cost from 70 to 85 per cent. For further illustration it may be considered that the superstructure of the 100-ft. spans for the three conditions above will cost somewhere in the neighborhood of $1,500, $2,200 and $2,800 respectively; and the corre-

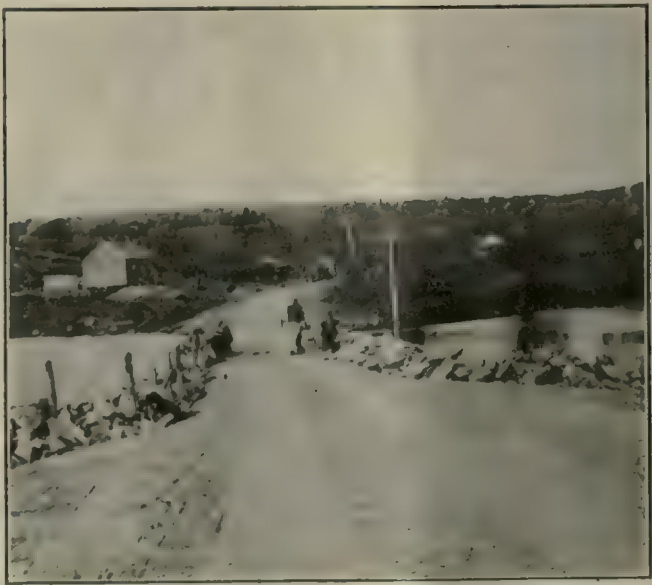

FIG. 6.—VIEW ON THE PITTSFIELD-HUNTINGTON ROAD AT ASHMERE LAKE.

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*From a paper entitled "Highway Bridges," read at the Road Builders' Institute held at the University of Washington, Seattle, Wash., May 1-2, 1916.

†Dean, College of Engineering, University of Washington.

sponding figures for the 200-ft. span are $5,000, $7,000 and $9,000.

Draggers, as Well as "Boosters"

BY M. COVERDELL

With that "show me" spirit which has made their native state famous, Missouri women have demonstrated that they believe in doing whatever is worthy of being "boosted," and in so doing have put their husbands and sweethearts to shame on the good roads proposition, as shown by the accompanying illustration.

With the growing popularity of better highways, "good roads days," or "road dragging days" have become quite the "style" out in Missouri during the past three or four years, especially during the spring months, when dragging is most effective. This season, however, the campaign for better roads was inaugurated earlier than usual, and presented a decided departure from established customs, when an army of Worth County women, thirteen weak (?), mounted on road drags, swung into Grant City, the county seat, a few weeks ago.

These enterprising farm women, who are banded together in a secret organization for rural improvement, had assembled several miles out in the country, and had dragged the roads into town before their husbands and sweethearts were aware of their intentions or movements.

WOMEN OF WORTH COUNTY, MISSOURI, AT GRANT CITY WITH THEIR ROAD DRAGS

The fair road draggers took the town by storm. Business men saw that they wanted for nothing dainty and refreshing in the line of "eats" and soft drinks; the Commercial Club treated and entertained them; their teams were decorated with "Old Glory," and the entire outfit was lined up on Main Street for a picture.

Later, the husbands and sweethearts of the fair draggers drove into town over the freshly dragged roads and pronounced them as good as (or maybe a trifle better than) if the men themselves had done the good work.

Governor Brumbaugh of Pennsylvania Works on the Roads

Although rain interfered with road work in some localities, the second annual Good Roads Day in Pennsylvania, on May 25, was marked by a spirit of cooperation and a great amount of useful work was accomplished.

Governor Brumbaugh and a party of officials of the State Highway Department, headed by Second Deputy Commissioner George H. Biles and W. R. D. Hall, Statistician of the department, worked all day on the roads of Dauphin and Perry Counties. At the end of the day, the governor issued the following statement:

"I want to thank the good people of Pennsylvania for the splendid assurance they gave to make our second 'state-wide good roads days' successful. I am gratified at the results I saw in the countries I visited today. Particularly impressive was the spirit of cooperation everywhere noticed, for such helpful consideration on the part of our people cannot but make for better roads in our Commonwealth and a better understanding of the necessity for the care of our highways.

"One thing attracted my attention especially in communities where the men and boys were working to improve the highways, the women and children were tidying up the homes by whitewashing the fences, cleaning up the yards, fixing the gardens and front lawns and, generally, doing their full share toward improving the appearance of the homes."

NEWS NOTES

The Heaving of Pavements in Cities of the Northwest during the early part of this year caused considerable difficulty. According to reports, the heaving was caused by the freezing of water which collected along the rails of street railway tracks, all of the trouble being on streets in which tracks were situated. The pavements affected were sheet asphalt and various block pavments, little if any difference being found in the manner or degree in which they suffered.

A New Street Lighting System in the City of Milwaukee, Wis., has been partially completed during the past winter. The work will be finished during 1917 and the total cost will be about $1,250,000. The installation of the system was undertaken after one of the most thorough investigations ever made of a street lighting problem. The new lamps include both electric and gas units, both of improved types. One of the outstanding features of the new system is that its design contemplates uniform illumination. Another is that the lamps are placed as high above the streets as practicable.

A Fifty Per Cent. Improvement in the Condition of Earth Roads by Means of the Patrol System is reported from Clayton County, Iowa. The county, which is in the northeastern portion of the state, and on the Mississippi River, has an elevation of from 600 to 1,250 ft. above sea level. The soil is very largely a light clay which washes easily and drains rapidly. The total road mileage in the county is 1,350 of which 226 are comprised in the county system. The patrol system is used on the entire mileage of the county roads. The average length of each patrol was formerly 10 miles, but during the past season was reduced to 7 miles in some parts of the county. The supervisors select the patrolmen who contract with the county to drag the roads at the time and place designated by the supervisors or the engineer. During 1915 the total cost of dragging on the county system was 56.5 cts. per mile per round trip, which is less than the amount paid for similar work in the average county in the state.

The Necessity for Adjusting Curb and Sidewalk Grades to Existing Conditions was emphasized by M. E. Chamberlain in a recent paper read before the Minnesota Surveyors' and Engineers' Society. Mr. Chamberlain pointed out that the establishment of such grades on sidehill streets is often a perplexing problem, and that the solutions which have been found have sometimes involved amazing extremes. It is not necessary, according to Mr. Chamberlain, to place the curb and walk at uniform elevations above the roadway, although this is sometimes done. Where necessary, according to Mr. Chamberlain, a 20 per cent. slope from the curb to the walk is not objectionable. He also pointed out that in hilly towns steps are occasionally necessary in sidewalks, and that in designing these it should be remembered that walking on the street is usually more rapid than indoor walking and consequently the tread of sidewalk steps should be considerably greater than those for stairs within buildings. He said that 15 ins. was a practical width, and that the risers could be approximately 6 ins.

AMERICAN ROAD BUILDERS' ASSOCIATION

150 NASSAU STREET
NEW YORK, N. Y.

President
E. A. STEVENS, Trenton, N. J.

First Vice President
A. W. DEAN, Boston, Mass.

Second Vice President
A. B. FLETCHER, Sacramento, Cal.

Third Vice President
WM. H. CONNELL, Philadelphia, Pa.

Secretary
E. L. POWERS, New York, N. Y.

Treasurer
W. W. CROSBY, Ba timore, Md.

Through the courtesy of the publisher of "Good Roads," this page, each month, is devoted to the use of the American Road Builders' Association. It is solely in the interests of the Association, and it is the desire of the Executive Committee that all members feel that this space is their own, and that they contribute freely to it, not only as regards anything concerning the Association itself, but also that which will further the good roads movement. Besides the official announcements of the Association, there will appear on the page contributions by members, items of news concerning the Association activities and personal notes about its members. All contributions should be sent to the headquarters of the Association at 150 Nassau Street, New York, N. Y.

Executive Committee:
Nelson P. Lewis
A. W. Dean
E. L. Powers

Special Meeting of the Association

A special meeting of the Association will be held at the headquarters, 150 Nassau St., New York, N. Y., at 4:00 p. m. on Friday, June 9.

The principal business to come before the meeting will be the canvassing of ballots which were sent out some time ago for a vote on a proposed amendment to the constitution. The amendment is designed to bring the terms of office of the present officers into conformity with the conditions brought about by the change made this year in the date of holding the annual convention. The proposed amendment provides that Section 2 of Article VI of the constitution shall read as follows:

"The President, Vice Presidents, Secretary and Treasurer shall be elected for one year. Six Directors shall be elected each year to serve for three years. The term of office of the officers elected for one year on February 4, 1916, however, shall end on the first Friday in November, 1916, and the term of office of directors now holding office shall end on the first Friday in November preceding the end of the term for which they have been elected."

A. R. B. A. Notes

Frank D. Lyon, formerly Deputy State Highway Commissioner of New York, has been appointed Superintendent of Streets of Binghampton, N. Y.

Dr. Joseph Hyde Pratt, State Geologist and Secretary of the North Carolina Highway Commission, is one of the speakers on the program of the annual convention of the North Carolina Good Roads Association which will be held at Wilmington, N. C., late this month.

Geo. C. Warren, President of Warren Brothers Co., of Boston, Mass., recently discussed methods of financing street improvement, in an interview on the subject of Boston streets. Extracts from the interview were printed in "Good Roads" for May 27.

J. E. Gillespie, formerly Division Engineer of the Wisconsin Highway Commission with headquarters at Grand Rapids, has been transferred to the Milwaukee Division.

Lamar Cobb, State Engineer of Arizona, presented a paper on "Federal Aid" at the annual convention of the Arizona Good Road Association at Phoenix on May 15 and 16.

Lester Kirschbraun, Consulting Engineer, Chicago, Ill., has been retained by the City of Beloit, Wis., to supervise the carrying out of the city's paving program for the current year.

Henry G. Shirley, Chief Engineer of the Maryland State Roads Commission, has been invited to speak at the coming convention of the North Carolina Good Roads Association.

W. S. Fallis, State Highway Engineer of North Carolina, is among those who are scheduled to speak at the coming annual convention of the North Carolina Good Roads Association.

Second Vice President Austin B. Fletcher, State Highway Engineer of California, was one of the speakers at the annual convention of the Arizona Good Roads Association which was held in conjunction with the convention of the Arizona Association of Highway Engineers at Phoenix on May 15 and 16.

Samuel Hill, Past President of the Association and Honorary Life President of the Washington State Good Roads Association, returned early last month from a brief visit to Europe, during which he dined with King Albert of Belgium, who took an active interest in the proceedings of the International Road Congress held at Brussels several years ago. An interview with Mr. Hill was printed in "Good Roads" for May 20.

NEWS NOTES

Clay County, Mo., will have an election June 24 on the question of issuing road bonds to the amount of $1,250,000.

San Diego County, Cal., voted strongly against a proposition to bond the county for $2,201,000 for the purpose of carrying out an extensive road building program.

The Execution of a Contract for Grade Crossing Elimination by the Railroad Affected is reported from El Paso County, Colorado. The highway, which is a heavily traveled tourist route, formerly crossed the Colorado Midland Railroad several times in a narrow canon. It was decided to eliminate two railroad grade crossings and four stream crossings by the relocation of a one-mile section of the road. The work required considerable heavy grading of which a large portion was adjacent to the railroad tracks. The railroad company was the low bidder and secured a contract for this part of the work. The grading was done with a steam shovel working from the railway tracks.

NEWS OF THE ASSOCIATIONS

Michigan State Good Roads Association

At the eighth annual convention of the Michigan State Good Roads Association, held at Battle Creek on the 10th and 11th of last month, President Philip T. Colgrove presented an unusually comprehensive report to the members.

Among the matters to which he called special attention were the association's activities in securing the passage of legislation, the work of the various organizations of the state in promoting the construction of different roads, the planting of shade trees along through routes, good roads and national defense, and the work of the Michigan State Highway Department. Many of these subjects were covered by reports which President Colgrove had secured from men identified with the different projects. Among the activities of the association which may be especially noted is the work which it has done in cooperating with various counties. In Van Buren County the association gave material assistance in the campaign for the adoption of the county system. In Oakland County it did similar work in a campaign for a $1,000,000 bond issue.

Included in the report was an account of the work of the Wolverine Pavedway Association, the East Michigan Pike Association, the Michigan Detroit-Chicago Highway Association and the Dixie Highway Association.

Much of the association's work in securing legislation was in connection with the Covert Act and the law providing for the taxation of automobiles according to weight and power. Considerable space was given to a discussion of these measures, and the hope was expressed that the attacks which had been made upon the law taxing automobiles according to horse power and weight would not be successful.

A considerable portion of President Colgrove's report was taken up by a discussion of data on state highway work in Michigan as furnished by State Highway Commissioner Rogers. This covered work done, the general situation in the state, and the prospects for work during the current year.

The Virginia Road Builders' Association

In order to secure effective cooperation in road betterment in any community or state it is necessary to have an organization of some kind, for success depends largely upon the activity of the most progressive and public spirited citizens, and however energetic and progressive they may be individually they can accomplish little working separately. There is also need of an organization of some kind for the dissemination of information regarding methods of construction and maintenance.

With these objects in view, the Virginia Road Builders' Association was organized in the early winter of 1911, and has since held annual conventions at which its members have devoted their time to the study of the problems incidental to road work.

The stated object of the association is, according to its constitution, "to discuss methods and means of road building and maintenance, and establish the most efficient systems and devices for doing the work." All persons who are interested in road building in the State of Virginia are eligible to membership. The dues are one dollar per year. The officers of the association are a president, a first vice president, a second vice president, and a secretary and treasurer. Regular meetings are held annually at such times and places as are determined by the executive committee. The officers are elected at the annual meetings for one year terms. Besides the executive committee, the constitution provides for such other committees as may be required.

The 1916 convention was held at Murphy's Hotel, Richmond, Va., on Jan. 18, 19 and 20, with an attendance of about 600 delegates. Among the speakers were Governor Henry C. Stuart of Virginia, Chief Engineer Henry G. Shirley of the Maryland State Roads Commission, State Highway Commissioner G. P. Coleman of Virginia, and others. Considerable attention was given at the meeting to the subject of earth roads. The use of the road drag was also discussed, and reports were made on the success attending its use in various parts of the state. Time was also given to questions of maintenance, bituminous construction, road laws and other related topics.

The present officers of the association are: O. L. Evans, Amherst, Va., President; Major J. B. Wood, Richmond, Va., First Vice President; G. Tayloe Gwathmey, Norfolk, Va., Second Vice President, and C. B. Scott, Richmond, Secretary and Treasurer.

It is the belief of those best acquainted with the work of road improvement in Virginia that the Virginia Road Builders' Association has performed a very necessary public service and has been the means of assisting the rapid advance of road improvement which has taken place in that state during the past few years. At the 1916 meeting several resolutions were adopted, most of these recommending legislation which, in the belief of the association, would make for better work in the improvement of the roads of the state.

An arrangement has recently been made by the association and the publishers of "Good Roads" whereby subscriptions to the twelve first-of-the-month issues of the publication are supplied free to members.

LETTERS TO THE EDITOR

Extension Work in Road Building by Pennsylvania State College

Editor "Good Roads:"

My attention has been called to an article in your magazine of April 8, 1916, entitled "Good Roads Education." In speaking of dirt roads and their improvement, the author says, "right here is where the average agricultural college falls down."

You may be interested in knowing the nature of the good roads work which we are attempting, in connection with the School of Engineering of Pennsylvania State College. The State of Pennsylvania has designated certain roads as state highways, and has improved, or plans to improve, them. There remains, however, the ordinary dirt road over which the majority of farmers must travel before reaching an improved highway. It is to these roads that we are giving our special attention.

An instructor who has had experience, and who has been with the Office of Public Roads and Rural Engineering, is to be sent out to meetings, called by the county agents, and by road supervisors, or meetings of groups of farmers, to talk to them on the subjects of drainage, culverts, small bridges, and the general problem of maintenance of dirt roads. The instructor will give demonstrations in the use of the road drag, and will attempt to get the farmers to cooperate in systematic dragging.

The State Highway Department is also interested in this problem, and has indicated its willingness to give us every assistance in this highway extension work. The subject is being tried out, between the school of Agriculture and Engineering, and if the farmers and road supervisors are interested, we expect next year to devote more of the time of a college instructor to educational work on our dirt highways.

R. L. Sackett, Dean,
School of Engineering,
Pennsylvania State Colleg.
State College, Pa.

COMING MEETINGS

June 5-7—National Conference on City Planning—Annual conference, Cleveland, O. Secretary, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

June 13-14—Intermountain Good Roads Association.—Annual convention, Ogden, Utah. Secretary, O. J. Stilwell, Ogden, Utah.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

National Conference on City Planning

The eighth National Conference on City Planning will take place at Cleveland, O., June 5, 6 and 7, the sessions being held in the auditorium of the Cleveland Chamber of Commerce and the ballroom of the Hotel Statler. The proceedings will commence with a luncheon at the Statler, at which delegates will make brief reports.

Among the subjects to be considered is "The Automobile and the City Plan." The subject as a whole will be treated by Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment, New York, N. Y., and from the special standpoint of traffic regulation by Police Commissioner Gillespie, Detroit, Mich. The discussion will be led by C. M. Talbert, Director of Streets and Sewers, St. Louis, Mo.

There will be a discussion of the subject, "Street Systems, including Transit Problems," by Major Joseph W. Shirley, Chief Engineer, Topographical Survey Commission, Baltimore, Md., Vincent S. Stevens, Akron, O., and Harlan P. Kelsey, Salem, Mass.

The convention will close with a banquet in the ballroom of the Hotel Statler, at which M. A. Black, Chairman of the Municipal Arts and Architecture Committee, Cleveland Chamber of Commerce, will be toastmaster.

BOOK NOTICE

THE NATIONAL ROAD, by Robert Bruce. Paper; 8x11 ins., 96 pp. and covers; illustrated. Published by the National Highways Association, Washington, D. C., and New York, N. Y., and Robert Bruce, Clinton, N. Y. $1.00.

The subject matter of this book consists largely of material which appeared in a series of nine articles in the "Club Journal," the official magazine of the Automobile Club of America, and is reproduced in book form through an arrangement between the National Highways Association, the Automobile Club of America and Mr. Bruce. The contents include a chapter devoted to a historical sketch and description of the Old National Road, and a series of eight chapters, each devoted to a particular portion of the highway. While usable as a touring guide through the medium of the many maps which supplement the text, the book is also of interest for the historical and descriptive data which it contains. It is profusely illustrated by half-tone reproductions of photographs of the road and scenes along it, and by the maps previously referred to which include routes through the cities as well as roads in the open country.

REPORTS

SOMERVILLE, MASSACHUSETTS; Annual Report of the Street Commissioner for the year 1915. Paper; 6x9 ins., 38 pp.

Included in this report are detailed data on the work of the street department during the calendar year of 1915 and a table showing the location, length and width of all of the streets of the city. The statistics on work done during last year are presented principally in the form of tables.

NEW YORK, N. Y., BOARD OF ESTIMATE AND APPORTIONMENT. Report of the Chief Engineer of the Board of Estimate and Apportionment for the year 1914. Paper, 6¾x10 ins., 235 pp., illustrated, inset maps and tables.

This report follows the general line of previous reports of the Chief Engineer of the board, and besides the Chief Engineer's report to the Mayor, includes the report of the Deputy Chief Engineer. The latter consists largely of inset tables showing details of the work of the board. There are several illustrations showing views before and after the elimination of railroad grade crossings, and several maps.

NEW YORK, N. Y., BOROUGH OF BROOKLYN, DEPARTMENT OF PARKS. Annual Report of the Brooklyn Department of Parks for the year 1915. Paper; 3¼x10¼ ins., 36 pp.; illustrated.

Part I of this report consists of a general review of the work of the department, and Part II comprises a detailed report of the work in each park, including the work on parkways and park roads. The illustrations consist of half-tone reproductions of views in the parks. These illustrations are printed on inset sheets of extra quality paper and consist principally of half-page and full-page halftones.

MARYLAND STATE ROADS COMMISSION; Fifth, Sixth, Seventh and Eighth Annual Reports, for the years 1912, 1913, 1914 and 1915. Cloth; 7x10 ins., 175 pp.; illustrated, inset map.

The first part of this report is devoted to a general description of the various phases of the commission's work during the four years covered. The latter part is devoted to a financial report, principally in the form of tables. Included also are lists of the officials and employees of the commission, an inset road map of the state, and many illustrations. The latter are full and half-page half-tone reproductions of photographs of roads before, during and after improvement, and bridges.

EQUIPMENT — TRADE — MATERIALS

New Ransome Street Paver

In the accompanying illustration is shown a Ransome Model 60, 1916 street paver, a machine recently put on the market, which was designed with an especial view to the elimination of unnecessary parts.

The boom has a maximum swing of 180 degrees and is built of two channels, back to back, the bucket trolley wheels running on the inside of the flanges. It is raised and lowered with a geared winch and pawl and is pivoted at the heel to a steel bracket fixed to an overhead frame.

The bucket has sufficient capacity to hold the entire output of the mixing drum, thus eliminating the necessity of making more than one trip for each batch of concrete. It is of the automatic tilting type so constructed that when stopped the locking arm is automatically released, allowing the load to be discharged, after which the counterweight immediately returns to its normal position. The boom bucket lines are operated by a friction drum which in turn is operated by bevel friction wheels with thrust bearings.

The mixing drum is of the standard Ransome type, the discharge chutes being operated by a handwheel at the operating platform.

The power plant consist of a boiler and an 8-HP. vertical marine engine with reversing lever. This type permits the elimination of reverse gearing and bearings. It has a 6-in. bore and a 7½-in. stroke with a brake test of 9½ HP. The boiler is 30 ins in diameter and 72 ins. high, fitted with full-length 2-in. tubes. It has a heating surface of 111 sq. ft. and develops 10 HP.

The main frame is built of heavy ship channels and I-beams. The traction wheels are of large diameter with broad treads, the driving wheels being banded and ribbed for traction on soft ground. The clearance between the ground and the under side of the front axle is 12 ins., making it possible to pass over standard height manholes when used at the center of the road. The front axle fifth wheel is pivoted, providing a three-point suspension, and the cams on either side of the frame inside of the wheel can be set to lock frame and axle to relieve the strain on the frame when the boom is being operated.

The hopper bucket is designed to hold the full volume of loose material without unnecessary trimming. It is open at the end, with ⅛-in. wearing plate extending over the end to allow barrows to enter without jolting. The width at the end is 66 ins., which is sufficient to permit two barrows to enter at once. It is provided with a dumping bar.

The machine has a traction speed of 4,775 ft. per hour, both forward and reverse. The time required for the bucket to travel to the end of the boom, discharge and return, is 19 seconds. All levers and handwheels used for controlling the machine are placed in such a position that the machine can readily be operated by one man.

The paver is built by the Ransome Concrete Machinery Co. of Dunellen, N. J.

New White Combination Sprinkler, Flusher and Distributor

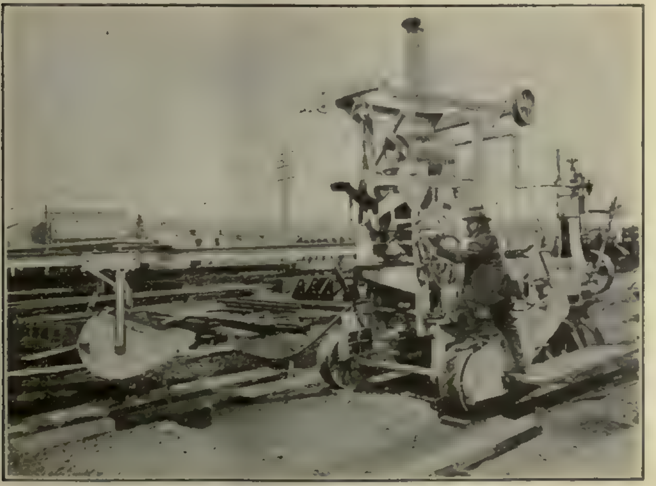
An outfit consisting of a motor-driven street sprinkler and flusher, and oil and asphalt distributor, designed especially for use in maintenance work, is shown in the accompanying illustration.

The outfit consists of a White chassis equipped with a tank with heating and distributing mechanism, a pump and auxiliary tanks. The machine can be used for applying bituminous materials, heated and under pressure if desired, and for water sprinkling or flushing. The machine is made in two sizes, one consisting of a 3-ton chassis carrying an 800-gal. tank, and the other a 5-ton chassis carrying a 1,000-gal. tank. Both are equipped with 45-HP. motors. The tanks are made of 3/16-in. steel and calked inside and out. The 1,000-gal. tank is 48 ins. in diameter and 10 ft. 6 ins. long.

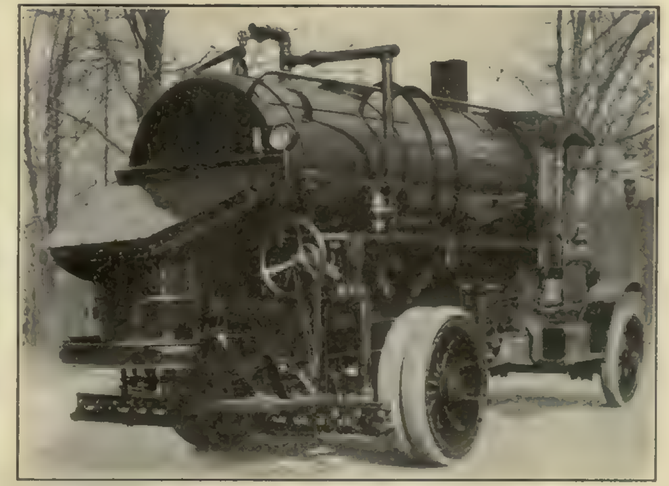
The pump is of the rotary displacement type and is capable of pumping 300 gals. per minute to the flusher, or delivering oil or asphalt under a pressure of 80 lbs. It has a lift of 13 ft. and may be used for filling the tanks from cars or storage tanks.

The heat is furnished by a gasoline burner and is distributed to the material by means of boiler flues leading through the tank to the stack. It is stated that the heater will raise the temperature of the tank full of material at the rate of one degree per minute, and will maintain a temperature of 350°.

Three sets of nozzles are furnished with the machine. The nozzles throw fan-shaped streams which overlap slightly and distribute the material uniformly. When the discharge is shut off, the pump carries any material remaining in the pipes back into the tank, and an automatic drip trough prevents the material from leaking down on the road.



RANSOME MODEL 60, 1916 PAVER.



WHITE SPRINKLER, FLUSHER AND DISTRIBUTOR.

The nozzles cover a strip of roadway 8 ft. 6 ins. wide, and are operated from a platform at the right hand side of the rear end of the tank.

The tank is cleaned after being used for oiling by pumping kerosene through it. One of the auxiliary tanks at the side of the machine holds the kerosene for this purpose. After cleaning, the tank can be filled with water and the machine used for street sprinkling or flushing.

When the machine is not in use as a distributor or flusher, the tank and distributing mechanism can be removed from the chassis and the latter used for general hauling.

The machine is made by the White Motor Truck Co., of Cleveland, Ohio.

Large Shipment of Road Machinery

In the accompanying illustration is shown a large shipment of road machinery recently made by The F. B. Zieg Mfg. Co., of Fredericktown, Ohio.

The photograph from which the illustration was made was taken after the shipment had been unloaded at Kenton, O., by Glenn Brothers, the local agents for the "Panama Line" of road machinery manufactured by the Zieg company. The shipment consisted of seven "Panama Giant" graders, one "Boston" grader, and a large assortment of road drags. It was sold to the highway authorities of Hardin County, Ohio.

LARGE SHIPMENT OF GRADERS AND ROAD DRAGS SOLD BY THE F. B. ZIEG MFG. CO., TO THE AUTHORITIES OF HARDIN COUNTY, OHIO.

"Concrete Facts About Concrete Roads"

Two publications, one bearing the title given above, and the other, entitled "Facts Everyone Should Know About Concrete Roads," have recently been issued by the Portland Cement Association of Chicago, Ill.

"Concrete Facts About Concrete Roads" is a 24-page booklet, 6 by 9 ins. in size, and profusely illustrated. The text consists of short chapters devoted to methods of construction, costs of construction and maintenance, methods of financing road improvement, and the benefits of concrete roads to the farmer, the motorist and the community. The illustrations are half-tone reproductions of photographs of concrete roads in various parts of the country.

The booklet is printed on unusually good paper and the illustrations are excellent.

The other booklet consists of 8 pages and cover and is 6 by 9 ins. in size. It is devoted to a recital of the advantages of concrete as a road building material and to data on the maintenance and construction of concrete roads. It also contains a table showing the yardage of concrete pavements laid on streets, roads and alleys in each state in the Union during 1915.

Natural Cement for Highway Work

An extensive advertising campaign now being carried on by a prominent manufacturer of natural cement has raised the question of the practicability of using that material in road and street work. During the past four or five years the use of cement concrete in highway work, both for foundations and wearing surfaces, has increased very rapidly, and because since before this increase began Portland cement had practically crowded out natural cement, the work has been done with the former material. It is now claimed by the natural cement manufacturer that his product meets every requirement of foundation work and that, in addition, it is cheaper than Portland cement.

As evidence to prove the assertion, the manufacturer cites experience with natural cement in highway and other work in many western and central states. Practically all of the older streets and roads, at least those that have a record of over 15 years, according to the manufacturer's claims, were built on natural cement foundations. These foundations, it is claimed, are still in good condition, some of them after 25 or 30 years of constant use, and are apparently good for as many years more. In this connection there is cited a recent statement made by George R. Grimes, a civil engineer, of Terre Haute, Ind. This statement is as follows:

"In 1893 the firm of Voorhees & Grimes, consisting of myself and J. E. Voorhees, constructed 21,300 sq. yds. of brick streets in this city, which stand today as monuments of hard surfaced highway construction.

"These streets were all laid on natural cement foundations, the concrete base being 6 ins. thick. Utica natural cement was used, the aggregate consisting of sand and crushed limestone.

"From six months to a year subsequent to the finishing of the construction, by my personal observation of making cuts and openings for gas and water connections, I found the concrete base perfect in bond and sufficiently set and hardened to justify its use for such purposes.

"After a lapse of from two to five years, upon such further observations, I found the concrete so firm and solid that it required much labor and the use of the best tempered implements to remove it, showing conclusively, in my judgment, that Utica natural cement was suitable for any kind of structural foundations.

"Up to the period of the introduction of American Portland, which was so much cheaper than the foreign product, we constructed many streets and alleys with Utica natural cement foundations which have proven beyond question that natural cement is highly suitable for concrete substructures.

"I think, however, there is no question but that a less quantity of Portland than natural cement will make as strong a structure and that its submerged setting qualities are far superior. These elements considered, together with a much cheaper American Portland, no doubt relegated the natural cements.

"However, in my opinion at least, if natural cement of the same uniformity and quality as the Utica brand can be made to compete with Portland (considering the ratio of quantity required) there is no reason why it will not answer equally as well today for all street and highway foundations for hard top surface."

Weight of Large Smith Mixer Described in the Issue of May 6

In the illustrated description of the two large concrete mixers, built by The T. L. Smith Co., of Milwaukee, Wis., printed under the caption "An Unusual Concrete Mixer," in the issue of May 6, the weight of the machine was erroneously stated. Through a typographical error the weight was given as 4,600 lbs., whereas it should have been 46,000 lbs.

The mixers referred to were two 4-yd. machines built to order for special work.

Paver Used as a Road Roller

A novel use of a paving mixer is shown in the accompanying illustration of a Chain Belt paver in operation as a road roller. The paver is owned by Samuel Friedman, a contractor of Glenwood, Iowa.

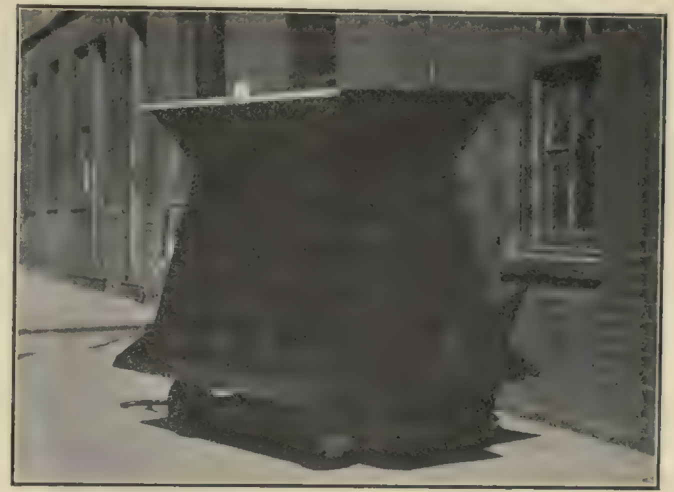
The entire subgrade for the paving job on which the mixer was being used, was rolled with the mixer, the wheels used consisting of ½-in. steel tires, 30 ins. in diameter, each 24 ins. long, which were slipped over the regular wheels of the paver. The outer half of each tire was filled with a 1:2 mixture of cement and sand. Mr. Friedman stated in a letter to the manufacturers that the entire expense of the work was about $75 which, he said, it would have been necessary to spend to ship a roller to the work. He also stated that the compression obtained was excellent.

CHAIN BELT PAVER IN USE AS A ROLLER.

The machine was a Belt Chain paver No. 15 manufactured by the Belt Chain Co., of Milwaukee, Wis.

Mullen Gravel Heater to be Manufactured by Littleford Brothers

A license to manufacture and sell the Mullen gravel heater and drier has been sold by the inventor, Charles A. Mullen, of New York City, to Littleford Brothers of Cincinnati, O., manufacturers of melting kettles and other equipment, who will hereafter manufacture and market the heater.



MULLEN GRAVEL HEATER AND DRIER.

The Mullen gravel heater and drier was devised by Mr. Mullen for his work as a paving contractor, and has been in use in New York City since 1910. An illustrated description of it was printed in "Good Roads" for July, 1910.

The apparatus consists essentially of a furnace built of perforated sheets of heavy metal, roughly in the shape of an inverted letter "V," with a hopper at the top, all mounted on a 4-wheeled truck. The ends are formed by solid plates in one of which is a fire door. To these plates are fastened the perforated flights arranged down the sides of the furnace as shown in the illustration. There is a stack at the end of the drier opposite the fire door, an ash can underneath the furnace at the front end and the usual arrangement of grates.

In operation the gravel is shoveled into the hopper which discharges on each side of the furnace between the upper perforated flight and the perforated plate forming the side of the fire box. The opening on each side is 5 ins. wide. The material passes down between the flights and the furnace, dropping out at the bottom into piles, from which it is shoveled to barrows. Only one man is necessary to tend the fire, shovel the cold, wet material into the hopper and shovel the dry heated gravel into barrows.

The temperature of the material can be regulated by the length of time that it is given to pass through the machine. The capacity of the heater shown in the illustration is stated as about 4 tons of gravel per hour. It is claimed for the machine that it saves time, fuel and labor, and that it will pay for itself in about three months of use.

Large Sales of Austin Motor Rollers

During the month of April the foreign and domestic sales of Austin motor rollers reached a total of nearly 200. The largest single sale was one of 146 rollers to the Russian government.

The Austin motor roller, manufactured by the Austin-Western Road Machinery Co., of Chicago, Ill., was the first road roller driven by a gasoline motor to be placed on the market in the United States. It was brought out nine years ago, and rapidly grew in favor with road builders. Since that time the sales have very materially increased from year to year, the shops having been enlarged four times to take care of the growing business.

The order placed by the Russian government in April was for rollers of three different sizes, 8, 10 and 12 tons. The machines are built to operate on Russian kerosene oil, which is obtained in large quantities from the fields in the southern part of the country. The Russian government has used Austin machines for some time, 50 of them having been in operation for a number of years.

TRADE NOTES

The Marsh-Capron Manufacturing Co., Chicago, Ill., has issued an illustrated folder describing the Marsh-Capron concrete mixers.

The Gould Manufacturing Co., Seneca Falls, N. Y., is circularizing highway contractors concerning the Gould road builders' pumps. The printed matter accompanying the circular is in two colors and is illustrated.

The Pennsylvania State Highway Department has awarded a contract for pneumatic tires and tubes for use on the department's cars during the year, to Burns Brothers, Harrisburg, Pa., on their bid for furnishing Federal tires and tubes.

E. I. DuPont de Nemours & Co., Wilmington, Del., have recently issued the "DuPont Products Book" which is a list and explanation of 251 distinct commodities manufactured by the company. The book is of handy pocket size, is illustrated and is bound in fabrikoid, a leather substitute manufactured by the company.

One of the most recent publications of the Orenstein-Arthur Koppel Co., Koppel, Pa., is Catalog No. 911, which is a booklet dealing with hauling equipment for road construction. Aside from descriptions of the Koppel industrial railways, the booklet is a sort of road builder's guide. There is a description of the Wayne County, Mich., concrete roads and the list of road building terms recommended by the American Society of Civil Engineers, as well as a quantity of useful information for road builders.

A booklet designated as "Bulletin No. 1" has recently been issued by the Galion Iron Works & Mfg. Co., of Galion, Ohio. The booklet is devoted to the subject of cast iron culverts, and includes in its contents an historical sketch of the use of cast iron pipes in this and other countries. The front cover carries an illustration of the dome of the capitol in Washington which, it is stated, is built entirely of cast iron. Other illustrations show cast iron pipe culverts and views at the company's factory. The booklet is 8¼ by 11 ins. in size, and consists of 16 pages, including covers.

NEW PUBLICATION

MINNESOTA HIGHWAY JOURNAL; Official publication of the State Highway Commission, Vol. I, No. 1, May, 1916; 9x12 ins.; published monthly by the State Highway Commission of Minnesota, St. Paul, Minn.

The first number of the "Minnesota Highway Journal" consists of four pages and is devoted almost entirely to a report on 1915 road work and a tabular statement of 1916 bridge work. The Journal, according to the commission's announcement, will be issued once a month for the general information of assistant engineers and others interested in the betterment of Minnesota roads and bridges. Besides the matter mentioned, the first number contains an article on bridge lettings in Minnesota, and another on the procedure for obtaining bridge plans.

A NEW PENETRATION NEEDLE FOR USE IN TESTING BITUMINOUS MATERIALS, by Charles S. Reeve and Fred P. Pritchard, Chemist and Assistant Chemist, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, reprint from the "Journal of Agriculture," Vol. V, No. 24. Paper; 7x10¼ ins., illustrated.

The contents of this publication consist of a discussion of the needles ordinarily used in the penetration test on asphalt and a description of the needles prepared by the writers with a view to improvement.

PERSONAL NOTES

A. B. Gidley has resigned as City Engineer of Marshfield, Ore.

S. N. Parker has been elected Commissioner of Streets of Emporia, Kan.

Joseph J. Duffy, a Chicago, Ill., contractor who did a large amount of municipal work, died recently at his home in that city.

Emil Diebitsch, M. Am. Soc. C. E., who was recently elected a commissioner of Nutley, N. J., has been designated Mayor-Commissioner of Public Affairs, Streets and Public Improvements.

Stanley H. Rose, until recently in charge of the New York, N. Y., office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, has been engaged by the Barber Asphalt Paving Co., Philadelphia, Pa., to direct its foreign trade department, with headquarters in Philadelphia.

NEWS NOTES

Additional Plans for Paving in Butte, Mont., bring the total of new paving to be done this season up to seven miles. The work will cost approximately $500,000.

Christian County, Ky., has voted $400,000 worth of bonds for road building, but has, as yet, been unable to dispose of them at what the authorities consider a satisfactory figure. The County Road Commission, however, has arranged with local banks to furnish the necessary money pending the sale of the bonds, and will proceed with the county's extensive road building program at once.

Gravel Road Work in Kane County, Illinois, on county roads is performed by the county with its own machinery. A noteworthy feature of the work is its prosecution in such a way that all of the hauling is done over material already laid, thus utilizing the motor truck which transports the materials as a roller. As a further means of securing thorough rolling the gravel is laid in two courses, after distribution from a bottom dump trailer in motion.

The Successful Use of a Flush Coat of Asphalt to Seal a Porous Road Surface at South Hadley, Mass., was described by E. H. Townsend at a recent convention of the Massachusetts Highway Commission. The porous condition appeared to be due to a preponderance of large particles in the aggregate. After various experiments it became evident that a denser pavement could not be obtained with the available aggregate, and it was found that the introduction of more asphalt was impossible, the aggregate having as much as it would carry. It was, therefore, decided to use a flush coat to seal over the surface. The material was applied from pouring pots and wiped with a squeegee to a uniform thickness. The asphalt was applied hot at the rate of about 0.6 gal. per sq. yd. and immediately covered with clean ¼-in. grit. The pavement has been in use for several months with results which are reported excellent.

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Notice to discontinue subscription should be sent to the New York office.

Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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New Bridge to Span Schuylkill River at Philadelphia, Pennsylvania

Plans are being prepared for a new bridge to replace the present structure across the Schuylkill River at South street, Philadelphia, Pa. The bridge will cost about $300,000, according to present estimates.

The specifications provide for plate girder construction, with a double leaf bascule span, 80 ft. wide. The floor will be of concrete with asphalt surface and provision will be made for four lines of roadway traffic.

New York State to Award Contracts for Highway Work

The New York State Commission of Highways will receive proposals June 26 for the construction of the following sections of state highway: Hamilton County, 4.22 miles; Otsego County, 12.66 miles, and Wyoming County, 3.52 miles.

In addition to this work, bids will be received at the same time for the repair of state highways in Albany, Cayuga, Cortland, Delaware, Essex, Herkimer, Livingston, Montgomery, Niagara, Oneida, Onondaga, Rensselaer, Sullivan and Westchester counties.

Concrete Road Construction Begun in the Hawaiian Islands

The construction of concrete roads has been started or is in contemplation at several places in the Hawaiian Islands. The most notable work, so far, has been done in the seaport town of Hilo, where, in the widening of Front Street, half of the roadway has been paved with concrete.

The volume of traffic and its effect on the pavement have been carefully observed and as soon as litigation regarding some of the new frontage is settled, the remaining half of the street will be paved. A concrete roadway connecting Front Street with the new Kuhio Bay wharf, three miles distant, has been completed.

As yet no concrete pavement has been laid in Honolulu, but it is proposed to build a military road from the city around Diamond Head, connecting finally with the main belt road which passes around the northern and western part of the Island of Oahu.

Wisconsin Highway Commission Forms a Second Division

The Wisconsin State Highway Commission has organized Division No. 2, with headquarters at Milwaukee. J. E. Gillespie, division superintendent, is in charge of the new office and will have a staff of four men.

Extensive improvements to the roads of Milwaukee County are planned and a five-mile section of the Blue Mound road in Waukesha County will be built to connect with the concrete roads of Milwaukee County.

The new division will have supervision over Fond du Lac, Sheboygan, Washington, Ozakee, Waukesha, Milwaukee, Walworth, Racine and Kenosha Counties.

No Advertising Signs on Highways in Orange County, California

An ordinance forbids the placing of advertising signs along county roads in Orange County, Cal., and recently, after due warning, a number of such signs, placed in violation of the ordinance, were removed by order of the County Board of Foresters.

C. F. Spellmeyer, Resident Engineer in Orange County for the State Highway Commission, has taken similar action with regard to signs along the state highway. This highway occupies a deeded strip upon which no advertising matter may be placed. Permits may be secured for structures to encroach upon the right of way, but no advertisement will be permitted on any part of such structures.

Col. Stevens Recommends New Method of Road Control in New Jersey

Col. Edwin A. Stevens, State Road Commissioner of New Jersey, has recommended to Governor Fielder's Road Commission, the introduction of the French road system, modified to suit conditions in New Jersey. The proposed plan provides for the organization of a state road force, which shall be subject to civil service rules and have charge of all road work involving state aid.

In his report containing the recommendation, Col. Stevens refers to the road system at present in use in New Jersey, as a "mass of laws" and states that any new legislation should embody a comprehensive plan for the business-like administration of a state-wide system of roads, based on a thorough study of existing statutes.

Reviewing present conditions, Col. Stevens remarks that in road control, the state reserves to itself only negative powers and that even these could be rendered valueless if the community did not ask state aid. It is his opinion that the handling of the difficulties incident to the sudden growth of traffic in New Jersey is beyond the capacity of local bodies unless aided and controlled by a central body.

Col. Stevens' plan contemplates a classification of highways. This would involve first the elimination of streets, boulevards, park roads and the like which, from their nature, must receive treatment entirely different from that accorded country roads. With these out of the way, the remaining roads would divide themselves naturally into at least three classes, namely:

Roads of importance to the whole state, that is to say, trunk lines carrying a large amount of through traffic. These would be state highways.

Roads of secondary importance, main feeders to the trunk lines or connecting points of secondary importance. These would be county roads.

A third class would embody roads of local importance only which, however, would be of greater importance than their classification would indicate, owing to their influence on real estate values and on the cost of delivery of farm products.

The selection of state highways would be done by state authority, preferably by a board. These highways would comprise about 10 per cent. of the country road mileage of the state and carry about 65 or 70 per cent. of the traffic. County roads would be limited to about 20 per cent. of the total country road mileage, would carry from 15 to 25 per cent. of the traffic and would be designated by boards of freeholders, subject to state approval. Local roads would comprise the remainder of the country road mileage and would carry between 10 and 20 per cent. of the traffic.

With regard to the organization of a state road force, Col. Stevens' plan recommends an official of the character of a chief engineer as the head of the force. There would be two or more grades to the organization, the upper one being composed of engineers and the other or others of inspectors, foremen, overseers and patrolmen. Admission to the force would be by civil service examination and vacancies in the upper grades would be filled by promotion whenever practical. Application for state aid on the part of any public body would presuppose the employment of none but members of the state force except for ordinary labor.

Additional Contracts for Highway Construction and Repair in Ohio

The State Highway Department of Ohio will receive bids on Thursday of next week for additional highway construction and repair costing $1,352,702.92, according to estimates. The construction work is located in 28 different counties and includes bridge and culvert work as well as road construction. Dates set for the completion of contracts vary from August 1 to December 15.

Counties in which the work is to be done, together with the mileage, type of construction and estimated cost are given below.

Ashland, 3.01 miles bituminous macadam and reinforced concrete, $47,853.53; alternative bids on brick, $49,676,18; 1.45 mile bituminous macadam, $20,455.56; alternative bids on brick, $20,270.36; 0.43 mile bituminous macadam, $5,800.20; alternative bids on brick, $5,734.90; 1.37 mile bituminous macadam, $19,554.93; alternative bids on brick, $19,364.88. Champaign, repairing bridge over Mad River, $789.08. Clermont, 1.25 mile water bound macadam, $9,920.98; 1.05 mile water bound macadam, $9,421.48; 1.04 mile water bound macadam, $7,734.46. Coshocton, 2.37 miles water bound macadam and surface trated macadam, $7,480.71. Delaware, 1.80 mile tar or asphalt macadam, tar, $23,716.95, asphalt, $25,202.25. Erie, 2.23 miles water bound macadam, $18,946.70; 0.72 mile water bound macadam, $9,017.65; alternative bids on concrete, $10,303.65. Fairfield, 2 miles water bound macadam, $17,153.60; 2.06 miles water bound macadam, $21,733.40, or bituminous macadam, $29,281.05. Fayette, 1.87 mile bituminous macadam, $17,333.94; 7.25 miles bituminous macadam, $58,064.78. Gallia, 1.04 mile water bound macadam, $9,594.43. Geauga, 5.64 miles concrete and brick, $71,481.74. Harrison, 3.01 miles water bound macadam, $34,373.49. Hocking, 3.04 miles water bound gravel, $16,867.14. Knox, 0.94 mile water bound macadam and reinforced concrete, $16,911.40. Logan, 1.32 mile water bound macadam, $11,960.50. Lorain, 8.93 miles bituminous concrete, tar, $155,294.11; asphalt, $157,805.53, or reinforced concrete, $163,570.47, or bituminous macadam, $125,385.86. Madison, 3.49 miles reinforced concrete and brick, $60,282.71, to be let in three separate contracts. Marion, 3.10 miles water bound macadam, $29,544.25. Medina, 1 mile concrete, $11,542.88. Meigs, 1.13 mile brick, $24,102.30; 1.33 mile reinforced concrete, $21,804.89. Montgomery, 2.01 miles brick, $45,833.57; 1.44 mile brick, $31,532.70; 1.59 mile brick, $42,942.86. Morgan, 2.37 miles water bound macadam, $32,763.27. Muskingum, 1.45 mile bituminous macadam, $18,359.62. Perry, 4.26 miles reinforced concrete, $99,046.50; alternative bids on brick, $89,305.50. Portage, 2.63 miles plain concrete, $28,189.99. Preble, 4.28 miles bituminous macadam, $46,859.84; 1 mile surface treated macadam, $7,069.85. Seneca, 4.37 miles water bound macadam, $44,266.63; alternative bids on bituminous macadam, $54,926.63. Shelby, 3.75 miles water bound macadam, $38,082.72. Wyandot, 1.01 mile brick, $22,252.90.

The contracts for maintenance and repair include the following: Franklin, 2.87 miles resurfacing with bituminous macadam, $22,042.02, or solid, natural lake asphalt, $23,931.25. Lucas, 1.13 mile bituminous surface treatment, $3,143.70; 0.75 mile bituminous macadam surface, and 5.28 miles surface treatment, $6,395.44; 3.74 miles bituminous surface treatment, $1,854.28; 2.66 miles patching and surface treatment, $1,712.62. Portage, 2.6 miles bituminous macadam resurfacing, $24,260.39. Preble, 4.45 miles surfacing with bituminous macadam, $28,667.82. Ross, 1.02 mile water bound macadam, $6,496. Wayne, 1.03 mile, widening roadway to 16 ft. and resurfacing with bituminous macadam, $9,225.12.

Motor Tax Receipts for County Road Work in New York State

According to a bill passed by the New York Legislature at its recent session and signed by Governor Whitman, as noted briefly in "Good Roads" for May 27, 50 per cent. of the receipts for motor vehicle licenses is to be apportioned among the counties, the remaining 50 per cent. being retained by the state.

The law provides that on or before the tenth day of each month, the Secretary of State shall pay to each county treasurer half of the registration fees collected from their respective counties during the preceding month. The first apportionment will be made during July. It is expected that the fund will amount to approximately $2,500,000 during the year.

For the five counties included in the City of New York the money will be turned over to the city chamberlain to be placed in the general fund. In all other counties the law provides that the funds shall be used for road work.

Basing the estimate on the receipts for 1915, the average amount per county will be in the neighborhood of $9,000, although there will be 16 counties outside of New York City, where the receipts will run considerably over this figure. These counties and the approximate amounts they will receive are as follows:

Albany, $16,685; Broome, $11,530; Chautauqua, $11,695; Dutchess, $12,244; Erie, $71,457; Jefferson, $10,943; Monroe, $50,920; Nassau, $19,904; Niagara, $13,937; Oneida, $14,359; Onondaga, $28,112; Orange, $14,824; Rensselaer, $10,046; Suffolk, $22,629; Westchester, $49,588.

Shortage of Laborers Hampers Highway Work in Many States

The New York State Highway Department is handicapped to a considerable extent by a shortage of laborers for work on the state highway system. Ordinarily about 30,000 laborers are employed on the state roads from May 1 to December 1, at from $1.75 to $2 a day, but contractors are finding it very difficult to secure enough hands even at higher figures.

The situation in New York is reflected to a greater or less extent in practically all other states and is due, of course, to the war in Europe which has taken large numbers of Italian and other foreign laborers from the United States.

Cleveland, Ohio, Planning for Large Amount of Street Improvement

Street improvements costing approximately $10,500,000 are under consideration in Cleveland, O., with more than a fair chance of being put through, according to recent information.

The City Council has already agreed to submit to a vote of the people at the August primaries a proposition to issue bonds to the amount of $3,500,000 for the purpose of opening and extending 106 streets. It is probable also that a further issue of $3,000,000 will be submitted to a vote at the November election. These funds are intended for use in paving repaving and improving existing roads and streets.

The County Commissioners of Cuyahoga County, of which Cleveland is the county seat, have agreed to pay one-third of the cost of improving portions of county roads lying within the city limits and to take care of the expenditure by an emergency tax levy. This would leave one-third to be paid by the city and a similar proportion by the owners of abutting property.

According to present plans, the division of cost of the proposed improvements figures out in this way:

City street openings and extensions to be provided for by bond issue to be voted on in August, $3,500,000.

Paving county roads, city's share to come out of $3,000,000 bond issue to be voted on in November, $2,000,000.

County's share of the cost of this improvement to be provided by emergency tax levy, $2,000,000.

Taxpayers' share to be assessed against abutting property, $2,000,000.

Street improvements to be paid for by the city out of $3,000,000 bond issue, $1,000,00; or a total of $10,500,000.

An ordinance has been passed by the City Council authorizing the employment of prisoners on street work, but Director of Public Welfare Beman is said to be opposed to the plan and is quoted as saying he will not avail himself of the authority.

NEWS NOTES

The City Council of Milwaukee, Wis., is considering alternative plans for a bridge across the Milwaukee River to connect Cedar and Biddle streets. One plan involves the expenditure of $180,000 and the other $192,500.

The Real Estate Board of Minneapolis, Minn., is back of a movement to pave seven arterial thoroughfares to the city limits with concrete. It is proposed to do the work under the Elwell law during the present season.

The State Highway Commission of California has requested all district attorneys and other prosecuting officers in the state, to make it a point not to permit mention of the make of the car in prosecuting automobilists for violations of the speed laws. The commission states that certain dealers are making a practise of testing the speed of their cars on parts of the state highway and using the records made for advertising purposes.

COMING MEETINGS

June 13-14—Intermountain Good Roads Association.—Annual convention, Ogden, Utah. Secretary, O. J. Stilwell, Ogden, Utah.

June 20-22.—North Carolina Good Roads Association—Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt. 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

Prizes at North Carolina Good Roads Meeting

One of the features of the convention of the North Carolina Good Roads Association, which will be held at Wrightsville Beach, Wilmington, N. C., June 21, 22 and 23, will be the awarding of first and second prizes for attendance. The conditions governing the awards have been worked out in considerable detail.

Awards will be made to the counties having the largest and next largest representations, based on the ratio of the number of persons attending to the distance traveled, the distance being figured on the railroad mileage from the county seat to Wilmington. Delegates from Wilmington will not be counted. Thus 125 persons from a county whose county seat is a distance of 25 miles or less from Wilmington will be rated the same as 100 from a distance of 26 to 60 miles, or 75 from a distance of 61 to 90 miles, or 50 from a distance of 91 to 150 miles, and so on.

Awards will also be made to the two cities having the largest representation. Conditions similar to those noted above will apply to these awards with the additional provision that the ratio of the attendance to the population of the city will be considered. Thus 100 delegates from a city of 40,000 population and over will be rated the same as 75 from a city of 25,000 and less than 40,000, or 60 from a city of 25,000 and less than 30,000, or 50 from a city of 20,000 and less than 25,000, and so on.

Under similar conditions awards will be made to organizations for attendance and distance traveled.

There will also be awards to the counties making the best exhibits illustrating road work. These awards will be made according to points as follows. County road map, 20; photographs of improved roads, 10; photographs showing construction work, 5; photographs of roads before and after improvement, 5; photographs of county bridges, 5; chart illustrating method of handling road funds, 10; chart showing cost of improved road, bond issues, special taxes, etc., 10; cross section of roads, 5; samples of road materials used, 15; installation of exhibit, 15; total, 100 points.

Inter-Mountain Good Roads Association

The annual convention of the Inter-Mountain Good Roads Association will be held at Ogden, Utah, on Tuesday and Wednesday, June 13 and 14, with Dr. L. P. McCalla, President of the association, in the chair.

The opening session will be taken up with addresses of welcome by Mayor A. R. Heywood, of Ogden, and W. H. Wattis, President of the Weber Club, the president's annual address and a speech by Governor William Spry, of Utah. In the afternoon an inspection will be made of the concrete highway being built by convicts for Weber County.

State Road Engineer E. R. Morgan, of Utah, will lead a general discussion in the evening and this will be followed by papers on "Automobile Tourists," by J. David Larson, Secretary of the Salt Lake Commercial Club, and "Relation to Road to Horse and Load," by Prof. William Peterson, of the Agricultural College, Logan, Utah.

The following papers are scheduled for the Wednesday morning session: "Government and Forest Roads," L. F. Kneipp, District Forester, Ogden; "Idaho State Highways," Governor Moses Alexander, of Idaho, and "The Automobile and the Road," A. G. Batchelder, Chairman of the Executive Committee of the American Automobile Association.

In the afternoon there will be instruction in the building of earth and concrete roads and a demonstration of oil and tarvia topping. The convention will close in the evening with a paper on "Construction of Earth Roads," by State Highway Engineer E. M. Booth, of Idaho, and an illustrated talk on concrete road construction by a representative of the Portland Cement Association.

MEETINGS

Road Meeting for Eastern Michigan

A meeting of those interested in the construction of good roads in the eastern part of Michigan was held at Saginaw, Mich., May 24 and 25, under the direction of the State Highway Department.

State Highway Commissioner Rogers was the principal speaker, his address being on the selection of types for county road systems. R. W. Roberts, district road engineer of the Saginaw district, spoke on macadam and gravel road maintenance. A series of discussions was led by several county road commissioners.

A feature of the meeting was a demonstration of scarifying, reshaping and rebuilding a worn macadam road, under the direction of County Highway Engineer W. J. Cleary of Berrien County.

The Cabrillo Comercial Club of San Diego, Cal., at a recent meeting was successful in organizing a society of San Diego County engineers, which will have for its chief purpose the placing of authentic engineering data at the disposal of taxpayers. J. E. Sellers is president and Paul Watson is secretary of the organization.

At the state convention of County Supervisors of California, held at Redding, Cal., May 26, resolutions were adopted favoring the proposed $15,000,000 bond issue for completing the state highway system. Another resolution endorsed a bill exempting public officials from personal liability through defects of county bridges or other public works.

PERSONAL NOTES

C. W. Cooper has been appointed City Engineer of Anniston, Ala.

S. K. Titus has resigned as City Engineer of Arkansas City, Kan.

J. R. Crissey has been appointed City Engineer of Johnstown, Pa., vice Lee Masterson, resigned.

A. F. Macallum, City Engineer of Hamilton, Ont., has been appointed Commissioner of Public Works at Ottawa, Ont.

Charles Pratt has resigned as City Engineer of Chanute, Kan., to accept an appointment as City Engineer of Erie, Kan.

G. N. Wood has been appointed City Engineer of Chanute, Kan., succeeding Charles Pratt, whose resignation is noted above.

NEWS OF THE TRADE

The Hauck Manufacturing Co., Brooklyn, N. Y., has issued Bulletin No. 58-A describing among other things the Hauck patent kerosene burners for use under asphalt kettles.

The Ransome Concrete Machinery Co., Dunellen, N. J., has opened a showroom in the loop district of Chicago, where an exhibit of the various machines and implements manufactured by the company will be maintained.

NEWS NOTES

The Board of Councilmen of Dunkirk, N. Y., plans to spend about $250,000 for paving this season.

The Report of the Grand Jury of Richland County, S. C., commends the excellent condition of the county roads.

Advices from Atlanta, Ga., state that owing to the strict enforcement of prohibition laws, there is a shortage of convicts which is hampering paving work.

The Fiscal Court of Campbell County, Ky., has planned road improvements which will cost about $161,095. Of this sum, $8,595 will be expended for grading alone.

The Board of Supervisors of Santa Clara County, Cal., has approved plans prepared by County Surveyor I. L. Ryder for 14 miles of county highways to cost about $200,000.

The County Commissioners of Roan County, W. Va., will employ an engineer to prepare plans and specifications for improving the county roads at a cost of about $250,000.

The Department of Agriculture, Commerce and Industries of South Carolina intends to have each of the main arterial highways of the state designated by distinctive markers.

Fayette County, Ky., will construct 20 miles of improved roads on four important highways leading out of Lexington with the proceeds of a recently voted bond issue of $300,000.

Carbondale, Pa., Authorities have decided to issue no permits for tearing up streets for the purpose of laying pipes until four or five years have elapsed after new pavements have been laid.

Chairman Zouck of the Maryland Roads Commission has protested against the Adamson bill, now pending in Congress, which abolishes the payment of motor license fees by residents of the District of Columbia for using Maryland roads. Maryland's contention is that the state has more than 1,000 miles of highways while the district has only a comparatively small mileage of city streets and that a fair reciprocal agreement is impossible.

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Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

Copy for all advertisements of which proofs need not be submitted—including "Proposal," "For Sale," "Want" and other classified advertisements—will be accepted until noon on Thursday of the week of issue.

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Pennsylvania Highway Department Reports Increased Motor Registration

The Automobile Division of the Pennsylvania State Highway Department reported the receipt of $2,002,462 in motor vehicle registration and license fees from January 1 to the close of business June 12. The total amount received from January 1 to December 31 last year was $1,665,276.50, or less than was received up to April 25 this year.

State Highway Department officials expect that the total amount received this year will exceed $2,225,000. From June 12 to December 31, 1915, the department received $210,205.50. Even granting that these figures are not exceeded this year, the total receipts would be $2,212,667.50, but it is considered likely that the amount from now on will be nearer $500,000.

Special Court to Handle Traffic Cases in New York City

A traffic court to handle none but cases involving violations of city traffic ordinances was instituted in New York, N. Y., on Wednesday of this week. There were 50 cases on the calendar for the first day.

The need for such a court is apparent in statistics gathered by the office of the President of the Borough of Manhattan. According to these, there are 2,500,000 persons resident in the borough, and to these must be added at least 1,000,000 more persons who come into the borough every business day. In the New York district there are registered 103,000 motor vehicles and 13,000 horse-drawn vehicles, a very large proportion of which use the streets of the borough.

That the proper handling of the traffic resulting from this population is a problem probably without parallel in the world will be readily appreciated, especially when the topography of the borough is taken into consideration. It is felt that a special court can handle traffic cases more uniformly and that the experience gained by the court will have a constructive influence on further traffic legislation.

Lorain, Ohio, to Employ City Jail Prisoners on Street Work

The City Council of Lorain, O., has passed an ordinance authorizing the employment on city street work of city jail prisoners serving sentences for petty offenses or for nonpayment of fines and costs assessed in the criminal courts.

It is provided that prisoners so employed shall be paid at the rate of 15 cents an hour until they have served out their sentences. The execution of the ordinance is placed in the hands of the director of public service, who is empowered to delegate police powers to overseers who will supervise the work.

Scott County, Kentucky, Plans to Improve 32 Miles of Roads

Seven state aid highways in Scott County, Ky., aggregating 32.41 miles, will be improved by the County Fiscal Court, which will receive bids for the work on Tuesday of next week.

The improvements include bridge and culvert work in addition to road construction. The roads on which the work will be done are the Georgetown and Cincinnati Road, 8.75 miles; Stamping Ground and Owenton Road, 4.50 miles; Georgetown and Frankfort Road, 5.75 miles; Georgetown and Lexington Road, 3.44 miles; Georgetown and Paris Road, 4 miles; Georgetown and Old Oxford Road, 4.22 miles, and the Depot Road, 1.75 mile.

Creation of Highway Commission to be Urged in Georgia Legislature

According to present plans, Representative Turner, of Baker County, Ga., will introduce a bill providing for the creation of a state highway commission, at the coming session of the General Assembly of Georgia, which convenes June 28. The bill was drawn by Judge Moses Wright, President of the Rome, Ga., Chamber of Commerce, and Charles S. Davis, former Commissioner of Game and Fish.

The bill provides for a state highway commission of three members to be appointed by the governor for a term of six years, except that the first appointees shall serve for two, four and six years, respectively. The commissioners are to be allowed expenses, but are to receive no salary.

The commissioners are empowered to appoint an official to be known as the superintendent of public highways, who shall be a civil engineer and a road builder of experience, at a salary not to exceed $400 a month. The commissioners are also authorized to appoint such assistant engineers as may be deemed necessary at salaries not to exceed $150 a month.

It is provided that the commission shall have general supervision over the building and improvement of public roads; of locating and designating a system of state roads; of extending aid in supervision and construction and maintenance of roads and bridges; of administering road funds from whatever source; of organizing, in conjunction with county authorities, convict labor forces for work on the roads and of all other matters properly belonging to a highway department.

With regard to convict labor, the bill provides that the Prison Commission of Georgia shall arrange for a reapportionment of the felony convicts of the state to the counties on a definite basis, as follows: First—15 per cent. of all able-bodied, long-term felony convicts shall be apportioned for work in state highway gangs, to consist of approximately 35 convicts each. These state highway gangs are to be worked directly under the control of the state highway superintendent and his assistants. Their work will be primarily on the construction of permanent highways connecting the commercial centers of the state. Second—In similar work on the next most important highways until each county in the state has a highway connecting it with the most important markets. While engaged in this work it will be incumbent on the counties in which state highway gangs are working to provide funds for the maintenance of the gangs. The remaining 85 per cent. of the felony convicts are to be apportioned to the counties under supervision of the county authorities.

The upkeep of the commission is to be provided for, according to the bill, from the receipts for motor vehicle licenses which, after the passage of the bill, are to be paid direct to the commission instead of to the secretary of state as at present. The bill provides the following schedule of license fees: Motorcycles, $2; automobiles of less than 25 horsepower, $5; 25 and under 35 horsepower, $7.50; 35 horsepower and under 50 horsepower, $10; 50 horsepower or over, $15; motor trucks of one-ton capacity, $5; two-ton capacity, $7.50. three-tons or over, $10. Paid drivers of automobiles, $3; paid drivers of auto trucks, $2.

Street Railway Company Will Pay for Paving in Baltimore, Maryland

The street railway interests of Baltimore, Md., which were relieved by a court decision from the payment of paving taxes amounting to about $1,000,000, have offered to pay $100,000 toward the paving of four important city streets if the work can be done this year.

An agreement has been reached between the railway interests and city officials that $50,000 of the amount will be paid by the railway on July 1 and the remainder when the work is completed. The paving involved includes portions of Linden Avenue and Monument, Calvert and Light Streets.

Recently officials of the Maryland State Roads Commission and members of the Baltimore Paving Commission made an inspection of those streets which the city desires to improve with its share of the state roads loan fund. The city is entitled to receive about $500,000 from this source.

Columbiana County, Ohio, to Award Twenty-four Road Contracts

The County Commissioners of Columbiana County, O., have called for bids on the improvement of 43.94 miles of roads, to be opened on June 20, 21 and 22. The work embraces 24 contracts, the largest of which is the Lisbon-Salem Road in Center and Salem Townships and involves an estimated expenditure of $100,000. The total estimated cost of the work is about $590,000.

The bids to be opened on June 20 include 7.45 miles of monolithic brick, 3.55 miles of water bound macadam and 4 miles of bituminous macadam. On June 21, bids are wanted on 5.50 miles of monolithic brick, 3.52 miles of water bound macadam, 8.10 miles of bituminous macadam and 2.62 miles of grading. Bids for June 22 include 1.40 mile of monolithic brick, 3.32 miles of water bound macadam, 0.87 mile of bituminous macadam and 3.48 miles of grading.

Pike County, Illinois, Considering Plan to Build 150 Miles of Roads

Leading citizens of Pike County, Ill., are back of a movement to construct a system of roads connecting all of the cities and villages in the county.

The plan calls for the construction of 150 miles of roads, and the matter will be presented to the Board of Supervisors with a view to submitting a bond issue to the voters of the county.

In the meantime a traffic census will be taken to determine on which roads the proposed work should be started. It is proposed to use local materials and labor as far as practicable.

Active Campaign for $7,000,000 Road Law in New Jersey

A question of no mean importance in the coming political campaign in New Jersey will be the Egan good roads law which was passed by the last session of the Legislature and signed by Governor Fielder, as noted in "Good Roads" for April 22.

The law, which was introduced in the Legislature by Senator Charles Egan of Hudson County and which will be submitted to a referendum at the November election, provides for a bond issue of $7,000,000 for a state highway system. Reports state that there is considerable objection to the proposition in many counties, principally on account of the creation of state indebtedness, which is not popular in New Jersey.

Those favoring the project, however, point out that as the law provides for the payment of interest and the ultimate liquidation of the bonds out of the receipts of the Motor Vehicle Department, there will be no burden whatever upon the general taxpayers of the state.

The law provides for a commission to consist of the Governor, the President of the Senate, the Speaker of the House, the State Road Commissioner and the chairmen of the Senate and House Highway Committees. It provides for the improvement of 13 routes, embracing about 525 miles and touching every county in the state with the exception of Hudson and Cape May. The routes designated are as follows:

No. 1. From Elizabeth to Trenton, by way of Rahway, Metuchen, New Brunswick and Hightstown.

No. 2. From Trenton to Camden, by way of Bordentown, Fieldsboro, Roebling and Burlington.

No. 3. From Camden to Absecon, by way of Berlin and Hammonton.

No. 4. From a point on Route No. 1 in or near Rahway to Absecon, by way of Perth Amboy, Keyport, Middletown, Red Bank, Long Branch, Asbury Park, Point Pleasant, Lakewood, Tom's River, Tuckerton and New Gretna.

No. 5. From Newark to the bridge crossing the Delaware, by way of Morristown, Dover, Netcong, Budd's Lake, Hackettstown, Buttsville and Delaware.

No. 6. From Camden to Bridgeton, by way of Woodbury and Mullica Hill.

No. 7. From Hightstown to Asbury Park, by way of Freehold, Jerseyville and Hamilton.

No. 8. From Montclair to state line at Unionville, by way of Singac, Wayne, Pompton Plains, Butler, New Foundland, Stockholm, Franklin Furnace and Sussex.

No. 9. From Elizabeth to Philipsburg, by way of Westfield, Plainfield, Bound Brook, Somerville, White House, Clinton, West Portal and Bloomsbury.

No. 10. From Paterson to Fort Lee, by way of Dundee Lake and Hackensack.

No. 11. From Newark to Paterson, by way of Belleville, Bloomfield, Nutley and Passaic.

No. 12. From Paterson to Philipsburg, by way of Little Falls, Pine Brook, Parisippany, Denville, thence over Route No. 5 to Budd's Lake, thence to Washington and Broadway.

No. 13. From New Brunswick to Trenton, by way of Kingston, Princeton and Lawrenceville.

It is further provided that the routes shall be as short and direct as practicable. Existing roads may be utilized wherever it is convenient to do so, but the opening of new roads over rights of way to be acquired may be provided for whenever the commission deems such action desirable. The law specifies that the materials used shall be granite, asphalt or wood blocks, concrete, bituminous concrete, asphalt or "other pavement having a hard surface and of durable character."

With regard to the financing of the project, it is pointed out that the receipts of the Motor Vehicle Department last year were somewhat in excess of $1,100,000 and were devoted to road maintenance. The proposed highway bonds would take about $550,000 of the fund for principal and interest the first year. It is estimated, however, that the motor vehicle receipts will increase 20 per cent. a year for about three years, when a nearly stable basis will be reached. This increase in returns, it is asserted, will take care of the bonds and still give the counties approximately what they are receiving for road maintenance.

A committee has been formed by those supporting the law, to create sentiment in its favor, and to this end meetings will be held in all parts of the state between now and Election Day.

Florida State Road Department Now Ready to Assist Counties

The organization of the State Road Department of Florida, which was authorized by the last session of the Legislature, has been completed and the department is now in a position to take up actively the work for which it was created.

William F. Cocke, State Road Commissioner, has sent a letter to this effect to all county boards and circuit court clerks, stating that the department has already compiled maps of 28 of the 52 counties of the state. The remaining counties will be mapped as soon as all of the necessary data are received.

Commissioner Cocke's letter also calls attention to the fact that the department is ready to furnish assistance to the counties in making surveys and in preparing plans, estimates and specifications for road and bridge work. Under the law, this work is done without other charge to the counties than the payment of actual traveling expenses, where such are incurred.

The law provides that a quarterly report of all road work done in the counties shall be filed with the department.

Roads in Southwestern Maine, which were badly damaged by a recent storm, as noted in "Good Roads" for May 27, are rapidly being put into condition by the State Highway Commission and the various towns which have day and night forces at work.

The Utah State Board of Education has endorsed a plan to teach road building as a part of the high school course in civics. It is planned to have the students do maintenance work on public highways leading to the schools and this will constitute "laboratory work" in the road building section.

COMING MEETINGS

June 20-22.—North Carolina Good Roads Association— Annual convention, Wilmington, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt, 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials— Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

September 13-15.—Washington State Association of County Commissioners—Annual meeting, Tacoma, Wash. Secretary, J. C. Hansen, Port Angeles, Wash.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association— Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

County Commissioners of Washington

The annual meeting of the Washington State Association of County Commissioners will be held at Tacoma, Wash., September 13, 14 and 15. The State Engineers' Association has accepted an invitation to participate in the proceedings.

While the program has not been completed, the following papers have been arranged for: "Highway Bridges," Dean A. F. Fuller, College of Engineering, University of Washington; "Greater Efficiency and Economy in County Government," Rufus C. Holman, President, Oregon State Association of County Judges and Commissioners; "Experimental Research as Applied to Road Materials," Prof. H. K. Benson, University of Washington; "County Pavements," R. H. Thompson, consulting engineer, Seattle; "Washington State Roads and Permanent Highways," James Allen, Washington State Highway Commissioner.

There will be a banquet at which Frank B. Cole, of Tacoma, will be toastmaster, and it is planned to have an exhibit of road-making machinery and materials.

Society for Promotion of Engineering Education

The twenty-fourth annual meeting, known as the Virginia meeting, of the Society for the Promotion of Engineering Education, will be held at the University of Virginia, University, Va., June 19, 20, 21 and 22.

A program has been prepared consisting of papers on various topics and reports of the committees appointed for the consideration of special subjects, each report being followed by a discussion. The election of officers will be held at the morning session on June 21.

Those attending the meeting will be entertained at a reception at the Colonnade Club and at a smoker on the first day. On Tuesday, following a luncheon to visiting ladies at the

Blue Ridge Club, there will be a trip to Monticello, the home of Thomas Jefferson. Wednesday afternoon there will be a reception by Dean and Mrs. Thornton of the university, and the annual dinner will take place Wednesday evening.

MEETING

The Engineers' Club of Baltimore, Md., has elected the following officers for the ensuing year: President, Alfred H. Hartman; Vice President, Henry G. Shirley; Secretary-Treasurer, William D. Janney; Directors, Thomas D. Pitts, Edward F. Ruggles and Richard K. Meade.

PERSONAL NOTES

H. L. Hudson has resigned as City Engineer of Laporte, Mich.

O. A. Gierlich has been appointed City Engineer of El Monte, Cal., vice Robert L. Wood, resigned.

John E. George has been appointed assistant to Chairman Frank H. Zouck of the Maryland State Roads Commission.

James A. Traphagen has resigned as County Superintendent of Highways of Monroe County, N. Y., owing to ill health.

George B. Marshall, Superintendent of Road Construction, U. S. Office of Public Roads, has been assigned to the State of Texas.

B. L. Field, Assistant Superintendent for R. G. Lassiter & Co., engineers and contractors, Oxford, N. C., has been placed in charge of a contract for 100,000 sq. yds. of paving at Wilson, N. C.

Louis Moyer, Seneca Falls, N. Y., has been appointed County Superintendent of Highways of Monroe County, N. Y., succeeding James A. Traphagen, whose resignation is noted elsewhere in this column.

Elswood Usinger, one of the leading road and bridge builders of New Jersey, a member of the Delaware River Bridge and Tunnel Commission and of the Board of Chosen Freeholders of Gloucester County, N. J., died recently.

NEWS OF THE TRADE

The Holt Manufacturing Co., Stockton, Cal., has issued a folder, printed in two colors, describing the Holt "Caterpillar 45."

The Lee Loader Co., Chicago, Ill., has moved its offices and factory to 2343 South La Salle Street, where it has secured the larger quarters needed to take care of its increased business.

McMahon, Farrington & Baker, engineers and contractors, have recently organized, with offices in the Press Building, Binghamton, N. Y. The firm will do paving and other contracting work.

The Asbestos Protected Metal Co., Pittsburgh, Pa., announces that it will be represented in Cincinnati, O., and surrounding territory by E. G. Irwin, with offices in the Union Trust Building, Cincinnati.

The Waterloo Cement Machine Corporation, Waterloo, Ia., has issued a 24-page booklet describing the new model Wonder concrete mixers. The booklet is printed in two colors and is profusely illustrated.

The Jennison-Wright Co., Toledo, O., has recently moved its offices to 263 Broadway, Toledo, where, in order to accommodate its growing business, the company has erected a new building to be used exclusively for offices. The new location is convenient to the company's plant.

The financial section of the "Boston News Bureau" states that Warren Brothers Co., Boston, Mass., has $2,500,000 6 per cent. preferred and $2,000,000 common stock on which it has just begun to pay 4 per cent. The preferred represents cash investment, while the company's patents and inventions are represented by the common. There are nearly 500 stockholders, of whom about 400 live in Boston. During 1915 the company laid pavements in 179 municipalities, embracing 6,979,366 sq. yds., of which only 50,238 sq. yds. were in the City of Boston.

NEWS NOTES

Ouachita Parish, La., recently voted $500,000 worth of bonds for road construction.

Springfield, Mass., is considering a plan to widen Dwight Street 20 ft., at an estimated cost of $1,241,000.

The City Commission of Bismarck, N. D., has decided to pave two miles of streets at an estimated cost of about $400,000.

The Annual Budget of Butler County, O., recently completed by the Board of County Commissioners, provides a road fund of $136,000.

The Legislature of Porto Rico has authorized the issuance of bonds to the amount of $2,000,000 for the construction of roads and bridges.

San Bernardino, Cal., will have a special election July 25 on the question of issuing bonds to the amount of $140,500 for municipal improvements. Among other things, it is proposed to build three steel bridges.

Lakeview Avenue, Dayton, O., will be paved with brick by the city forces owing to the inability of the city to obtain satisfactory bids from contractors. If the experiment is successful, other streets may be paved in a similar manner.

The Pittsburgh, Pa., Council is considering a resolution which would prevent any improvement costing more than $100,000. If adopted, the resolution would hold up for at least two years, several large street improvements now under consideration.

Edgmont Avenue, Chester, Pa., is to be widened to 60 ft. between 3rd and 6th Streets, and made one of the principal business streets. The work is to be done by a local organization known as the Edgmont Avenue Improvement Association, which has a capital of $1,000,000. Practically all of the property needed for the improvement has been secured.

Barbourville, Ky., Business Men are raising a fund for the purpose of repairing the roads from the city north to Corbin and south to the Bell County line. Knox County, of which Barbourville is the county seat, voted $200,000 for road improvements about 14 months ago, but construction has been held up owing to disagreements over rights of way.

Five Important Links are to be added to the California state highway system in Southern California. These are the San Fernando link of 6.4 miles and the Whittier link of 14.1 miles in Los Angeles County, and the Goleta Boulevard, [illegible].7 miles in Santa Barbara County. These are constructed under county bond issues. Two units of 5.8 and 5.6 miles respectively in Mono and Ventura Counties, will be constructed by the state.

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Copy for advertisements of which proofs are to be submitted to advertisers should reach the New York office as follows: For insertion in the first issue of the month, by the fifteenth of the preceding month; for other issues, by noon on Thursday of the week before date of issue.

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Harbor Truck Boulevard to be Built by Los Angeles County, California

The Board of Supervisors of Los Angeles County, Cal., has decided in favor of constructing what is to be known as the Harbor Truck Boulevard, and County Road Commissioner Joyner has been authorized to advertise for bids for the construction of the first link.

It is intended that the road shall be used exclusively for trucks between Los Angeles and the harbor at San Pedro. The specifications call for an 8-in. concrete surface with an 8-in. granite rock base.

The first link of the boulevard will extend from Los Angeles to Compton, a distance of about ten miles, and will cost approximately $145,000, according to preliminary estimates.

Much Street Improvement Provided for in Philadelphia, Pennsylvania

The Committee on Surveys of the Philadelphia, Pa., Councils has approved ordinances providing for the development of a large territory in the extreme southwestern section of the city, including the establishment of new lines and grades for streets and the plotting of highways, boulevards, parking places and public parks.

In a series of ordinances provision is made for the highway improvements. Lines and grades of streets are to be revised in the district bounded by 63d Street, Elmwood Avenue, 70th Street and the Chester branch of the Philadelphia & Reading Railway.

The revision also will be extended in the section bounded by Woodland Avenue, Cobb's Creek, Darby Creek, 90th Street, Tinicum Avenue, Island Road and Island Avenue to provide for the establishment of streets within the territory bounded by these markings, and Darby and Bow Creeks, the back channel, the county line and the Delaware and Schuylkill Rivers.

On the new plans will be laid out streets, parkways and parks as may be necessary to complete the city plan within that area.

A revision to establish new streets, parkways, parks and parking places in the territory bounded by Roxborough, Ridge and Port Royal Avenues, Hagy Street, the county line and Wissahickon Creek, in the 21st and 22d Wards, is provided in another ordinance.

Supervisors of Adams County, Illinois, Create More State Aid Roads

At a recent session of the Board of Supervisors of Adams County, Ill., the Committee on State Aid Roads recommended the creation of several miles of additional state aid roads in order to bring the county's mileage up to the percentage allowed by law.

In accordance with the recommendation, the board included seven additional highways in the state aid list and took under advisement a proposition to issue bonds to the amount of $1,180,000 for the purpose of surfacing state aid roads.

Baltimore, Maryland, Paving Commission Gets $200,000 Loan

The Board of Estimates of Baltimore, Md., at the request of the Baltimore Paving Commission, has authorized the borrowing of $200,000 for the purpose of carrying out the commission's full paving plan for the current year.

The last of the $5,000,000 Baltimore paving loan stock appropriated to the commission, was sold this week and the commission still finds itself short the amount of the proposed plan, owing to adverse court decisions in the matter of the paving tax against the street railway interests. The plan is to pledge the 1917 paving tax as security for the loan.

Shawnee County, Kansas, Plans to Build Five New Bridges

It has been decided by the Board of County Commissioners of Shawnee County, Kan., to build five new bridges in various parts of the county, at an estimated cost of $53,612.54.

Notice of intention has been issued in accordance with the law in order to permit a vote on the question if a vote is demanded.

The details of construction and the estimated cost of the proposed bridges are as follows:

No. 1—130-ft. Baltimore truss, on stone abutments, over Soldier Creek, in Menoken Township; estimated cost, $13,149.50.

No. 2—130-ft. Baltimore truss, on stone abutments, over Soldier Creek, in another section of Menoken Township; estimated cost, $13,315.94.

No. 3—100-ft. Baltimore truss, on concrete abutments, over Wakarusa Creek, between Williamsport and Auburn Townships; estimated cost, $11,468.38.

No. 4—50-ft. steel-concrete span on concrete abutments, over Blacksmith Creek, in Dover Township; estimated cost, $7,695.96.

No. 5—50-ft. steel-concrete span, on concrete abutments, over Deer Creek, in Topeka Township; estimated cost, $7,982.76.

Proposals for Road Work Received by Ohio Highway Department

The State Highway Department of Ohio recently received bids in the fourth important letting of highway contracts during the present season. The work is to be done in 27 counties and the amount involved is estimated at more than $1,300,000.

Counties in which the work is to be done, together with the mileage and character of the work, the names of the lowest bidders and the amounts of the bids, are given below:

Ashland County—Jeromeville-Sullivan Road, 3.01 miles, E. F. Downs & Co., Toledo, bituminous macadam, $45,087.49; reinforced concrete, $46,766.90. Ashland-Oberlin Road, 1.45 mile, E. F. Downs & Co., bituminous macadam, $19,401.32; brick, $19,247.96. Ashland-Oberlin Road, 0.43 mile, E. F. Downs & Co., bituminous macadam, $5,513.72; brick, $5,427.94. Jeromeville-Sullivan Road, 1.37 mile, E. F. Downs & Co., bituminous macadam, $18,591.21; brick, $18,180.01.

Champaign County—Troy-Urbana Southern Road, repairing bridge over Mad River, Fred Nagel, Urbana, $746.

Clermont County—Bethel-Chilo Road, 1.25 mile, Hanlon Construction Co., Cincinnati, water bound macadam, $9,870.

Delaware County—Columbus-Wooster Road, 1.80 mile, Edwards Bros., Sandusky, tar bound macadam, $22,500; asphalt bound macadam, $24,350.

Erie County—Milan-Elyria Road, 2.23 miles, Huffman, Ackerman & Gillespie, Berlin Heights, water bound macadam, $18,133.50. Milan-Elyria Road, 0.72 mile, Buckeye Engineering Co., Norwalk, water bound macadam, $9,010; concrete, Central Construction Co., Fremont, $9,788.

Fairfield County—Lancaster-Kirkesville Road 2.06 miles, Arthur & West, Jackson, water bound macadam, $21,033.40; bituminous macadam, $28,581.05.

Fayette County—Hillsboro-Washington Road, 1.87 mile, Mark & Van Gundy, Washington C. H., bituminous macadam, $17,033.94. Cincinnati-Zanesville Road, 7.25 miles, Mark & Van Gundy, bituminous macadam, $57,479.78.

Harrison County—Cadiz-Carrollton Road, 3.01 miles, J. P. Warrick, Cadiz, water bound macadam, $32,884

Hocking County—Chillicothe-Logan Road, 3.04 miles, E. C. Radebaugh, Logan, water bound gravel, $16,860.14.

Knox County—Columbus-Wooster Road, 0.94 mile, Green & Gettman, Kent, water bound macadam and reinforced concrete, $16,450.

Logan County—Bellefontaine-Richwood Road, 1.32 mile, L. L. Allen, Larue, water bound macadam, $11,500.

Lorain County—Cleveland-Sandusky Road, 8.93 miles, Public Construction Co., Elyria, tar, $145,200; asphalt, $163,250; Highway Construction Co., Elyria, bituminous macadam, $113.424; Ohio Engineering Co., Lorain, reinforced concrete, $163,250.

Madison County—Urbana-London Road, reinforced concrete and brick, three separate contracts; Contract No. A, 3.07 miles, A. W. Burns & Co., Columbus, $45,994; No. B, 0.21 mile, $8.389; No. C, 0.21 mile, $3,153.

Marion County—Marion-Waldo Road, 3.10 miles, water bound macadam, L. L. Allen, Larue, $28.400.

Medina County—Medina-Norwalk Road, 1 mile, concrete, Kennedy-Warner Co., Medina, $10,688.78.

Meigs County—Pomeroy-Marietta Road, 1.13 mile, brick, Wm. Miller, Gallipolis, $22,564. Middleport-McArthur Road, 1.33 mile, reinforced concrete, Mumaw & Ross, Huntington, W. Va., $20,906.

Mongomery County—Dayton-Indianapolis Road, 2.01 miles, brick, D. A. Onkst & Son, Dayton, $45,581. Dayton-Greenville Road, 1.44 mile, brick, Clifton Hoolihan, Dayton, $30,941. Dayton-Covington Road, 1.59 mile, brick, D. A. Onkst & Son, $41,605.

Morgan County—McConnellsville-Athens Road, 2.37 miles, water bound macadam, Curtis & Thoenen, Greenville, $31,243.31.

Muskingum County—Zanesville-Cincinnati Road, 1.45 mile, bituminous macadam, J. A. Swingle Construction Co., Zanesville, $17,295.63.

Perry County—New Lexington-Athens Road, 4.26 miles, reinforced concrete, H. C. Foster & Son Richmond, Ind., $98,200; brick, $88,800.

Portage County—Cleveland-Kent Road, 2.63 miles, concrete, S. S. Senter, Canton, $27,461.35.

Seneca County—Fremont-Tiffin Road, 4.37 miles, water bound macadam, B. D. Knopper, Tiffin, $39,996.63; bituminous macadam, $50,916.63.

Shelby County—Sidney-Wapakoneta Road, 3.75 miles, water bound macadam, Sousley & Botkins, Ada, $35,422.72.

Wyandot County—Kenton-Upper Sandusky Road, 1.01 mile, brick, Modern Construction Co., Fremont, $21,940.

Franklin County—Columbus-Marysville Road, 2.87 miles, repairing and extending the bridges and culverts, grading and shaping roadway, resurfacing with bituminous macadam, P. J. Conley, Columbus, $20,962.46; solid lake asphalt, $28,851.69.

Lucas County—Toledo-Elmore Road, 1.13 mile, patching and applying bituminous surface treatment, Barrett Co., Cleveland, $3,143.70. Toledo-Lansing Road, patching, applying surface treatment to all but 0.75 mile and surfacing with bituminous macadam to 0.75 mile, length 6.03 miles, Doan & Langendorfer, Toledo, $6,345.44. Holland-Sylvania Road, 3.74 miles, surfacing with bituminous treatment, Barrett Co., $1,854.28. Toledo-Ann Arbor Road, 2.66 miles, patching and applying surface treatment, Barrett Co., $1,712.62.

Portage County—Aurora-Warren Road, constructing bridges and culverts, grading roadway and resurfacing with bituminous macadam, length 2.6 miles, Wright & Chessel, Kent, $23,263.33.

Wayne County—Cleveland-Wooster Road, constructing the bridges and culverts, grading roadway, widening to 16 ft. and resurfacing with bituminous macadam, length, 1.03 mile, The J. C. Devine Co., Alliance, $8,398.64.

Warren Bros. Co., Filbertine Patent Upheld by United States Court

Judge Dickenson in the United States District Court for the Eastern District of Pennsylvania, Philadelphia, Pa., on June 17, rendered a decision for the plaintiff in the case of Warren Brothers Co., vs. W. C. Evans of Ambler, Pa.

The case grew out of the award of two contracts by the Pennsylvania State Highway Department for Filbertine Road to the defendant in the suit. The plaintiff corporation set up the claim that the Filbertine specifications provided a construction which infringed upon its basic patent, which had already been adjudicated in other courts, and that the defendant's claim of anticipation was merely a chance construction showing a lack of uniformity even on the two wagonloads of asphalt and gravel mixture used.

The construction of the two Pennsylvania highways was held up pending a disposition of the case and is now enjoined. The highways are No. 131, Chester County, East

Marlboro and Kennett Townships, 19,978 sq. yds., and No. 30, Huntington County, Henderson Township, 38,555 sq. yds.

Judge Dickenson's decision contains an interesting ruling on patents and anticipation and is given below:

Due to the interesting subject matter of this controversy, or to its admirable presentation by counsel, or doutless to both, it is with a feeling almost of regret that we accept the compulsion to take the excluding view of it which we have taken. The case in its formal features is the ordinary one of the claim of a proprietary right in a product based upon the issue of letters patent and a denial of their validity. The patent bears the number 727,505, was issued for the claimed invention of Frederick John Warren and now belongs to the plaintiff by assignment. The invention is based upon the discovery or recognition of a fact which however familiar it may be to the initiated seems so startling to the uninformed mind that there is a hesitation in its statement for fear of misconception. The fact, however, as we understand it is this: If a delimited space be occupied, as nearly as may be, by broken material of a uniform unit size of the parts of which it is made up the proportion of the total volume of the space which will be void or unoccupied by the material will be about the same no matter what the size of the unit parts. If it is desired to relatively reduce the voids this result is accomplished not by reducing the size of the unit parts (still retaining their uniformity), but by varying the sizes of the parts. The desired condition of a road when perfected is that the material of which it is composed should present the feature of a solid mass in that the whole road space should be free from voids. Time and use direct their efforts towards bringing this about and would eventually accomplish this result were it not for the faster working disrupting influences of water, frost and the displacing pressure of heavy travel. This solidity must, in consequence, be produced before the road is used. The ideal construction is then the mosaic. The large voids between the large units to be filled as nearly as may be with units as large as the space will accommodate and to repeat this down to the smallest units and then to cement the whole by a binder so that you have a road unit made up of solid material. The vital elements of the defense presented require the claims of the patent to be so interpreted that the defendant's pavement can be held not to infringe or to compel an interpretation so broad as to open them to the successful assertion of anticipation. The real, at least, in the sense of the first, question involved is whether there is now any question which is an open one, always excepting, of course, the question of infringement. There is a substantial (although not a formal) concession that the present case is to be so determined. Independently of the merits of the question of the validity of a patent, there must come a time when that question must be deemed to have been settled whether rightly or wrongly, nevertheless, settled. If this be not so, rights evidenced by letters patent are no rights at all. All which can profitably be said upon the subject of the validity of this patent (except upon subsequently discovered evidence of anticipation) is embraced in the opinion accompanying rulings already made. That of Judge Lurton and the comments of Judge Anderson afford a sufficient reference. This patent was issued May 5, 1903. Time will therefore soon heal any hurt which the upholding of its validity may have done to the rights of others. Such validity is supported by the prima facie findings of the Patent Office. It has confirmation in a juridical experience so extensive that a mere list of the cases in which it has been litigated, would unduly lengthen this opinion. This experience has embraced adjudications not only in a number of the District Courts but in the Circuit Courts of Appeals in two different circuits, and recognition in three other circuits supplemented by consideration in almost, if not quite, a round dozen of applications for preliminary injunctions. Out of all of this judicial consideration something in the nature of the establishment or denial of some definite rights must have resulted. What we find has resulted is the establishment of the validity of claims 5, 6, 9 and 11 of this patent beyond the reach of successful attack upon any grounds then litigated. (Warren v. Owosso, 166 Fed., 309. Warren v. New York 187 Fed. 831.) However free courts of different territorial jurisdictions, having equal powers and of like authority (such as the appellate courts of the several states and circuit courts of appeal), may be to accept or refuse guidance from each other, trial courts ordinarily do not enjoy and cannot, without just criticism, assert a like freedom. We deem ourselves controlled by the rulings of circuit courts of appeal of other circuits until the court of our own circuit has passed upon the same question. This, of course, is not because of the *res adjudicata* principle but of comity and the acceptance of decided cases as a statement of what the law is. Because of these rulings there remains in this case only the question of infringement and the consideration of any evidence of anticipation not before considered. This view places the burden of the argument after prima facie evidence of infringement upon the defendant.

The defense of anticipation may first be considered. The only new feature in this is the so-called McGovern, or more properly, Blake, pavement or part of a pavement which has been found in an alley at the rear of No. 1442 Arapahoe Street, in the City of Denver. The genesis of this pavement is worth tracing. It antedates the Warren patent. Parts of it bear a strong likeness if not similitude, to the bitulithic pavement. In point of fact it would seem that parts of it could be found which would resemble almost anything. This is because of its origin. It cannot be said to have been made by McGovern who had nothing to do with its actual construction, nor by Blake, who did have something to do with it. It would be more correct to say that it made itself. It came into existence after this fashion. A pavement there could be laid only at the instance of abutting property owners. McGovern was one of them. All the others wanted, or were at least persuaded to accept, an asphalt pavement. McGovern insisted upon having stone. Doutless what he had in mind was a cobble-stone or belgian block pavement. The result of his attitude was that an asphalt pavement was laid except opposite his property. To meet his views or appease his opposition Blake, who was City Contractor, had stone dumped there. The broken stone was of all sizes. The material used in the paved part of the street supplied the necessary binder. It is now found that in places the mixture was such as to show a very fair counterpart of the Warren pavement. In other places the accidental mixture was different. Can this be said to be such an anticipation as to defeat the patent? Something of the same question arose in the former cases with respect to other pavements. It was met with the observations that if "somebody had in fact made the (Warren) composition before he did this does not necessarily defeat his patent."

In considering anticipation defences (prior use or prior invention) we start with the presumption that the patentee is the first inventor. This must be overcome and by that measure of proof which the law requires. The effect given to prior use, prior invention, prior publication, prior patents, is based upon essentially the same thought—the denial of the claimed invention. There are two thoughts in the statutory meaning of invention. One is the idea of originality, either of discovery or of creation; the other, the idea of priority or of novelty. Each of two or more persons may independently discover or invent something. Each is an inventor. One, however, was prior in time. The accomplishment of the second man lacks novelty. The policy behind the patent laws is applied in view also of two things. One is to encourage invention and stimulate effort by recognizing and rewarding merit. The other is to be just to other inventors and to the public. Neither the first inventor nor the public will have taken from them what is already theirs for the benefit of one who, however deserving as an inventor, has added nothing to the public possessions. There is also a secondary policy operating as a rule of evidence. It is pursuing a sound and indeed a necessary policy to assume the second producer knew of and had the aid of such knowledge of prior use, prior disclosures in publications, and prior patents—in other words, he is held to a knowledge of the prior art. The principle is clear enough, but when it comes to be applied in instances of prior use, or prior invention, common knowledge of human nature, or a very limited experience, will convince us of the necessity for extreme care in its application. Hence the rule requiring a high standard of proof to overcome the prima facie rights of a patentee. There is no suggestion of actual purloinment of ideas. There is no conflicting claim of another inventor. The real question here is whether the claimed discovery of Warren was already part of the public possessions. A very practical touchstone may be supplied in this test. A useful road can be made according to the Warren formulae. It is the product however to which he makes claim and not the process. If, therefore, someone had previously produced the product it had thereby become a public possession and it will not be taken from the public to be given to Warren. The quality of stability is one of the things which gives value to a road. The previously produced road (in common with the Warren road) possesses this quality. It is of no importance whether the maker of the road understood or could give a statement of the "why" of this result or had an appreciation of the principles of its construction. Road making is an art as well as a science. If McGovern or Blake had produced the Warren pavement before Warren did there was no novelty in the Warren product. This point of the argument for de-

[illegible] is clearly presented and driven home. Let us go to the extreme verge on the other side.

The practice of the art of road making was limited to a mixture of pitch and sand or fine stone, the small units of which were of a uniform size. Without thought or intention on the part of anyone, stone material or varying sizes had been dumped in some place together with some pitch. The mixture happened to be in such proportions of stone of different sizes and of pitch as that the result was the same as the material of the present bitulithic road. Subsequently someone discovered the present method of producing this material and was awarded a patent on his product. If the first dump-heap was found would its existence defeat the patent as an anticipation? Would it make any difference if the dump-heap further happened to be within the limits of a road? Between these two extremes is to be found the line which separates what is from what is not an anticipation. Anticipation is essentially a fact to be found. We do not think the existence of an isolated product blindly produced, and unrecognized for what it really was, never produced, and in that sense abandoned to oblivion, is sufficient merely because of its resurrection to defeat a patent. It would be inaccurate to call it "an abandoned experiment" because that would give it a merit which could not be claimed for it. It is found not to be an anticipation because there is in such an instance of production and use no prior use of this product.

If the plaintiff was relying upon a process and not a product claim, the defense of non-infringement would be hard to meet. As against a product claim the defense is as hard to allow without a denial of all right in the plaintiff. The differentiation which the State Highway officials make is impressive at first blush but, to use a colloquial expression, "gets us nowhere," because its statement of the different modes of road construction is no denial of the further statement that the product of the third may be an infringement of a product patent owned by the users of the first.

If it were not for the adjudications referred to we might readily yield to the persuasiveness of the very able counsel for defendant and be convinced by the forceful argument addressed to us, but we have not been able to see how we can follow him without refusing to follow courts by which this patent has been held valid. For this reason the bill of the plaintiff is sustained and the usual form of decree in favor of the plaintiff, with costs, may be submitted.

COMING MEETINGS

June 27-30—American Society of Civil Engineers.—Annual meeting, Pittsburgh, Pa. Secretary, Charles Warren Hunt. 220 West 57th St., New York, N. Y.

June 27-June 30—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

August 29-31—League of Cities of Third Class in Pennsylvania.—Annual convention, Johnstown, Pa. Secretary, F. H. Gates, Wilkes-Barre, Pa.

September 4-8—Southern Appalachian Good Roads Association—Ninth annual convention, Lexington, Ky. Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.

September 13-15.—Washington State Association of County Commissioners—Annual meeting, Tacoma, Wash. Secretary, J. C. Hansen, Port Angeles, Wash.

October 9-13—American Society of Municipal Improvements.—Twenty-third Annual Convention, Newark, N. J. Secretary, Chas. C. Brown, 702 Wulsin Bldg., Indianapolis, Ind.

February 5-9, 1917—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials, Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau St., New York, N. Y.

Pennsylvania Good Roads Day Association

Representatives from every county in Pennsylvania will meet at the capitol, Harrisburg, Pa., on Monday for the purpose of forming a state good roads day association.

This meeting is the outcome of a meeting held at Pittsburgh last spring when a number of representatives of western counties agreed to do all that they could to make Good Roads Day successful this year, and arranged for a meeting to be held in June in Harrisburg, at which time representatives from each county in the state would be invited to be present so that the state-wide movement might be perpetuated.

The Washington County representatives, headed by J. M. McKee, Secretary of the Washington County Good Roads Association, took the lead in the matter and it was arranged that Mr. McKee should send out the call for the June meeting.

Among those who will be present at this meeting will be Dr. W. D. Martin, of California, Washington County, to whom belongs the credit for having originated state-wide Good Roads Day in Pennsylvania. Dr. Martin is expected to make an address.

PERSONAL NOTES

A. B. Gilbert has been elected Commissioner of Streets and Public Utilities of Newton, Kan.

DeForest A. Wheelock has resigned as City Engineer of Warren, Pa., to enter private practice with his son, H. A. Wheelock.

Gault Applegarth, formerly a resident engineer for the Maryland State Roads Commission, has been appointed Road Commissioner for Chestertown, Md.

Alson Rogers has been appointed City Engineer of Warren, Pa., succeeding DeForest A. Wheelock, whose resignation is noted elsewhere in this column.

A. J. Fasenmyer of the Pennsylvania State Highway Department, has been appointed Road Superintendent for Blair and Cambria Counties, Pa., succeeding R. L. Devereaux, resigned.

Sidney A. Butler, who was prominent in the good roads movement and who organized the Los Angeles County, Cal., Good Roads Association, died recently at his home in Los Angeles.

James H. McClure, well known as a bridge contractor, died recently at his home in St. Paul, Minn. He is said to have built the first bridge across the Mississippi River at Anoka, Minn.

Mortimer L. Neinken, Brooklyn, N. Y., has been awarded the prize of $100 offered by the Barber Asphalt Paving Co., Philadelphia, Pa., to students of highway engineering at Columbia University, New York City, for an exhaustive study on "Comparison and Selection of Roads and Pavements."

Louis Moyer, Seneca Falls, N. Y., has been appointed Superintendent of Highways of Seneca County, N. Y., vice James A. Traphagen, resigned. Through an error it was stated in "Good Roads" last week that Mr. Moyer had been appointed Superintendent of Highways of Monroe County, an office which J. Y. McClintock has held for many years.

Yazoo County, Miss., has voted to issue bonds to the amount of $625,000 for the construction of roads.

The County Commissioners of Knox County, Ind., have awarded three contracts for gravel road construction. The aggregate mileage is 7.22 and the amount involved is $114,264.79.

The County Highway Commission of Humboldt, Cal., recommends a bond issue of $1,500,000 for the purpose of constructing concrete roads to connect all of the larger centers of population in the county.

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